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FARMERS DIGEST

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The Farmer's Digest

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The Farmer's Digest

Volume 3 March, 1940 Number 11

Farm Prices Go Up and Down

Henry J. Beckman

FARM prices are always going up or down. Specifically speaking, there is no such thing as static in the realm of farm prices. Back in the year 1800 some wise man conceived the idea of keeping a record of prices. About 80 commodities are included in that record. In later years the list has been broadened to include many things that at that early day were less important to human welfare. The lines showing the peaks and depressions of those years, as far as farm products are concerned, have fluctuated as steadily as the ocean tides but with a far less degree of regularity and with a far wider degree of variation.

Farmers, more than any other group, suffer from wide price fluctuations. As far as price instability is concerned, agriculture seems to have locked horns with fatal destiny. If the only way to judge the future is by the past it is highly probable that farmers will continue to face price instability and variation. If, therefore, the farmer accepts the challenge which his vocation holds he must synchronize his program with the unpredictable factors that he faces.

We are not here dealing with the problems of having the farmer get a larger share of the consumer's dollar. That such a plan will ultimately be worked out is the hope of many clear thinkers upon agricultural problems. Until such time comes, however, the farmer must mesh gears with the present economic structure and plan as best he can to cushion the margin between a more or less constant production cost and a constantly fluctuating market price.

Farming suffers more from price fluctuations than does industry because of several fundamental reasons. First of all it must be remembered that the farmer of today, unlike his pioneer ancestor, is no longer a self sustaining unit. No longer does

he produce the largest part of what he uses. It is apparent therefore that any economic system which penalizes the price of farm commodities through violent price fluctuations and tends to stabilize the price of industrial products through tariffs, trade agreements or by any other method, places agriculture at a serious disadvantage. When it is remembered that agricultural production is also at the mercy of weather conditions, a constantly varying and totally unpredictable factor, the precariousness of the farmer's position is increasingly evident.

Farming is a long time business. It sometimes takes a number of years to get a farm into shape to produce properly. With certain crops, like wheat in the plains area of the west, the time requirements are so long that great price fluctuations may occur between the time the crop is planted and harvested. This is a very important factor in those years when prices are definitely moving downward. Farmers producing fruits or nuts, for instance, where the development of the grove is a matter of several years, may find themselves coming into a low price cycle that may remain for several years just at the time when their groves are in their peak of production. Careful study of current plantings and non-bearing acreage that will come in within a few years, most of which data is now available to growers, may prevent disastrous mistakes in these long time programs.

The contrast between the position of the farmer and that of the merchant with regard to price fluctuations was plainly emphasized during the ten years of declining prices following the world war. Disregarding in this connection, the tendency of farm prices to decline much more sharply and more rapidly than those of industry, the gradual decline itself worked to the disadvantage of agriculture. Hardware, for instance, moving from the shelves every thirty days, would enjoy the advantage of twelve price changes during the year, each change being an adjustment to the current price level. The probable decline during a thirty day period would not be too great to be absorbed in the usual margin of profit and while the resale might make a very small profit, or none at all in extreme cases, it would not represent a cash loss. Farmers, however, having an annual crop and operating always at a very narrow margin of profit, might find themselves trapped with a high cost of seed, cultural and harvesting costs, plus an overhead of interest and taxes that had not yet been readjusted to the lower status, and going onto a market that, during the the twelve months since the crop

was originally planned and planted, had suffered a tremendous decline. If the situation continued then for a period of ten years, as it did following the war, it is evident that only the most favorably situated farmers could withstand such difficulties. Even more sharply does the position of the grocer differ from that of the producer in this respect. The vegetable counter of the average chain store is a matter of almost daily turn over. The price of potatoes for instance is a matter of a very short time to the dealer who holds the stock only a few days but to the farmer who planted and grew those potatoes it is a matter of several months and in the rotation of his crops it is a matter of programing his farm outlay over several years time. During so long a period of time sufficient price decline may occur as to upset the entire farm income even though production costs have remained fairly constant at a reasonably high level.

Not only do the prices received for farm products fluctuate more rapidly than do those of other industries, but the fluctuations are far more extreme than in most commodities. Here again the farmer's inability to switch quickly from one crop to another is an important factor, groves and orchards representing an extreme example. Illustrative of these wider variations that work to the disadvantage of agriculture is the situation that prevailed from 1920 to 1933. At the beginning of this period prices paid by farmers for the things they purchased stood at 201% of the 1914 base. By 1933 they had dropped to 107%. In the same period prices received by farmers, which were 211% of the 1914 base at the beginning, dropped to 65% at the end of the period.

Costs of producing farm products do not follow the downward trend nearly so rapidly as prices received for them. This was particularly true after the war when for six years industry continued to enjoy a fair degree of prosperity while agriculture's prices were badly deflated. Certain costs entering into farm crops decline very slowly. Fixed investments maintain a fairly steady charge. Interest and taxes do not follow the downward trend very rapidly. Freight rates do not make rapid or seasonal changes. In fact, many of the things that enter into the cost of farm commodities remain fairly constant even in those times when farm prices are rapidly declining. An instance of this kind in the matter of retail prices of food will illustrate the point, particularly since there is so close a relationship, fundamentally, between farm commodities and food. Between 1930 and 1932 food products dropped from 151% of the base price to 66%

but retail prices of food during those years dropped only from 169% to 113%. Many other things the farmers bought during that period declined even less.

Rigid marketing costs have a tendency to give farmers a higher percentage of the consumer's dollar when prices are high than when prices are low, since these costs represent a smaller percentage of the total selling price when prices in general are high.

One of the factors that affects farm prices is the ability of the consumer to buy the things that he wants and needs. When factories are idle the farmer shares in the loss. An exception, to some extent at least, prevails in years of short crops when a particular commodity may still enjoy a fairly good price.

Important among the factors that affect farm prices is the matter of trade agreements. Production and marketing costs, together with prices received, are determining factors in a farmer's financial venture. If another nation can produce a farm commodity and sell it in the world's market for less money the only way the American farmer can hold the trade is to lower his price. With fixed or fairly constant prices for freight, commission and other marketing charges the burden of price reduction invariably falls upon the producer of the raw material.

Price Cycles

Long term price cycles in the United State have, in the past, averaged about fifty years from peak to peak. Being directly associated with world conditions they have, in general, followed world prices fairly closely. The problem of stabilizing world prices is a stupendous and difficult one. In the years from 1790 to 1814 prices in general were on the upgrade. Then the tendency downward continued until 1849 changing again to an upward swing which reached its peak in 1870. The decline which then followed continued into the '90's and prices did not begin to advance until the turn of the century. This general advance reached its zenith about 1920, since which time the general tendency has been downward.

Within the longer cycles are shorter cycles sometimes known as recessions, occurring about every seven or eight years. A number of reasons, aside from climatic conditions that affect the total production of farm crops, have been advanced as the cause of these recurring depressions. Farmers certainly cannot in any manner control them. Economists have pointed out certain things that a farmer can do with relation to these depressions that will help in the individual's ability to meet these conditions. Among those things the curtailment of pur-

chases or production of those things that are at an extremely high level is particularly important. Generally speaking the price of any one farm product does not remain at either a very high or a very low figure for a long period of time. This is an important fact to be kept in mind in planning crop producton. The avoidance of the assumption of heavy obligations in times of high prices is usually a wise practice. High prices of farm products offer an excellent opportunity for most farmers to reduce their obligations. The same amount of obligation in dollars and cents will buy far more land, buildings or other improvements in times of distress, and the chances for paying off those obligations with higher priced products a few years later are much better, if the purchases are made when everything is low than if they are made at the peak of prosperity.

Farmers as a rule, by the very nature of their business, face the future with a reasonable degree of optimism. Without some measure of optimism they would never plant a crop nor breed an animal for future sale. Dry years, they have learned are usually followed by years of plentiful rainfall. The inconstancy of the season has inured them to the inconstancy of prices. From the factors beyond their control most farmers have turned for a measure of relief to an intelligent understanding and management of those things within their control.

Economies are always necessary. In times of low prices they are doubly so. Among the more resilient factors of a farmer's income is the matter of management income. The most inconstant in its rewards, it remains the most constant in its demands. Its capacity to contract and to expand makes it a valuable cushion between the lean and the fat years that fall upon the land.

Records kept by farmers and research agencies indicate a wide range in the cost of producing different farm products, not only on different farms but on the same farm from one year to another. Difference in feed costs alone between 1937 and 1939 made a difference of 10 cents per pound in milkfat and .03 per dozen in eggs in one cost study kept. Easily this is the difference between profit or loss in either operation. Time of the year when a crop is produced is important. A lamb born in May might be easier and cheaper to raise than a March lamb but make much less clear profit. In a cost study among owners of 10,000 hens the capital and management income per hen per year ranged from .00 to $2.25. The time of the year when the hens were laying, not the price of feed, was a determining factor.

The number of healthy pigs weaned and marketed per litter is often far more important than the price of hogs in determining whether the owner succeeds. One third of the pigs born on farms of the United States die before weaning and another third are so stunted by parasites that they never make a profit. These factors are among those that are, to a large extent at least, within the control of the farmer himself.

In a cost study of Lima beans covering four years the price varied only one cent per pound but the net income per acre varied $21.93. Thirty-two orange grove records showed 273 packed boxes for the high producers and 133.8 for the low producers in the same county and under similar climatic conditions.

On the whole, according to economists, farm production costs and selling prices tend to be equal. In some years practically everyone produces at a loss because of low prices. The inefficient producer is then penalized to the point of elimination and the law of the survival of the fittest takes its toll. Management income in such years, even for the most efficient, is minimized. With the return of good years the efficient manager soon begins to enjoy the usual margin above production costs, while the newcomer-and-outer has the problem of starting over again before him.

Predictions and forecasts for 1940 indicate that while production costs for farmers may average slightly higher than in 1939 the ratio of the price he receives to what he pays will be more favorable to the farmer than in the year now closing. Whatever 1940 may bring for agriculture, it is safe to assume that good farm management will be just as necessary and just as important as ever. The best manager may be assured of one premise, namely that he will find his managerial income increase, other things being equal, when farm prices go up and decrease when prices go down. If prices go too low he will have no managerial income at all, for managerial income is a farmer's regular shock absorber as he travels along agriculture's rough road. His big job is to manage his business as a producer so that he can establish a reserve in the good years that will carry him through the more difficult years when there is no margin for, if the future runs true to the past, farm prices will continue to go up and down.

Crossbred Lambs

Condensed from Successful Farming

L. H. Hartwig

PROGRESSIVE stockmen have long recognized that crossbred animals often have distinct advantages for market purposes over purebreds and high-grades. Scottish cattle- and sheep-breeders have been practicing crossbreeding for decades. Thousands of crossbred sheep are produced annually on our Western ranges. Cornbelt farmers have long marketed crossbred swine.

Yet, thru all these years, even tho the frequent superiority of the crossbred animal for commercial purposes was recognized, no one had deemed it practical to use crossbred animals in the breeding program. Haphazard use of crossbreds always resulted in a degeneration of the stock, soon producing scrubs and mongrels.

It is no wonder, then, that stockmen were aroused when the Minnesota Agricultural Experiment Station announced not long ago that crossbred swine could be used successfully in the breeding program. Here was something new and startling. Skeptics scoffed. Many of them are not yet convinced, but before making their announcement the Minnesota folks were sure that they had six years of intensive tests to back up their contentions.

And now, crossbred lambs, produced by a breeding program that makes use of purebred rams and crossbred ewes, are making stockmen sit up and take notice. Since 1924, W. L. Henning, secretary of the Southdown Association and animal husbandry professor at Pennsylvania State College, has been delving into the secrets of sheep crossbreeding, and he has reached some conclusions that are proving a bombshell in the industry.

Henning's experiments with crossbred sheep began as a result of the strategic position which Pennsylvania holds in the highly specialized hot-house-lamb industry, which calls for the production of lambs outside the regular season. A few large Eastern cities, particularly New York, Philadelphia, and Boston, demand a supply of these lambs during the cold winter months.

Altho crossbred ewes were used in the production of hot-house lambs, no experimental work had been done previous to 1924 to determine which cross or

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crosses might be most desirable. Henning determined to obtain a better understanding of the various crosses.

The foundation stock of grade Merino ewes was obtained in southwestern Pennsylvania, since this section has provided most of the ewes used by Eastern producers of hot-house lambs. These and similar ewes were mated to a registered Dorset ram to provide check groups and stock for further crosses. In later years grade Merino ewes have also been mated with Corriedale rams.

These crosses provided the basis for the breeding studies. Altho practical breeders and animal husbandmen frowned upon the use of second-cross ewes in the breeding program, this is exactly what the experimenters did. And then they went even further and used three-breed-cross ewes in the breeding program. Future plans call for the use of even more involved crosses to provide greater evidence relative to the value of crossbreds.

According to this year's records, everything is in favor of the crossbred lamb, particularly those tracing their ancestry to four breeds. Altho only a limited number of the latter were marketed, their market record is surprisingly good. By far the most outstanding individual was dropped by a Hampshire-Dorset-Merino ewe and sired by a purebred Southdown ram. Sold as a hot-house lamb, this individual graded very fancy.

It is significant that of the 15 lambs from the four-breed crosses marketed this year, one was graded as very fancy, nine fancy, and five good. One three-breed cross lamb, as already mentioned, attained the top grade of very fancy. Of the remaining 22 lambs of the three-breed matings, seven were fancy, nine good, and six fair. But of the lambs tracing their parentage to only two breeds (and this is the part of the record which really brings out the proof of superiority of further crossing), none were of sufficiently good quality to grade above the classification of good. Of 21 lambs, seven were good, seven fair, and seven poor. Notice that, of all the crosses used, the two-breed crosses produced the only lambs graded as poor. All were raised under exactly the same conditions.

This makes it a dollars-and-cents proposition. Considered from the standpoint of hot-house lambs, from 50 cents to $1.00 usually separates the price of one grade from that immediately above or below. Recently, a spread of $3 existed between the selling price of hot-house lambs on the New York market graded as very fancy and those graded as poor.

The dollar value does not ex-

plain the entire difference between the worth of hot-house lambs. These lambs are sold at so much per head. Actual weight is given little consideration if other requirements are met. A 30-pound lamb often sells for as much or more than another weighing 45 pounds. Quality and condition are given first consideration.

The four-breed-cross lambs selling in the upper price and grade classifications may be taken as an excellent indication of the ability of the three-breed-cross ewes to serve as mothers, since the growth of hot-house lambs is largely dependent upon the supply of mother's milk. According to Henning, both Dorset-Merino and Corriedale-Merino first-cross ewes have been excellent mothers.

The percentage of lambs produced by crossbred ewes has been at least equal to or greater than from purebreds.

The experimental work at Pennsylvania has centered around the production of hot-house lambs. Work thus far leaves little doubt that crossbreeding provides the answer for more profitable methods in this specialized industry.

The Cornbelt farmer and the Western range man have similar problems. Henning can see no sound reason why crossbreeding should not help them as it has the corn-growers and the pork-producers. Crossbreeding of poultry has been practiced with success. Crossbreeding of sheep for the production of high-quality, early-spring lambs is a common practice in Kentucky and Tennessee.

On the range, crossbreeding is an established practice. At the large feeder markets, black-faced lambs, the result of the use of thousands of Hampshire rams on fine-wool ewes, command a premium over white-faced lambs. Their rugged frames, strong constitutions, and early maturity make them very desirable for feed-lot purposes.

In other words, crossbreeding is adaptable to ordinary farm conditions. But not unless Henning's advice (always to use purebreds) is heeded. And they must be good purebreds to secure the desired improvement. As is so commonly done in the Cornbelt, a farmer can start with Western ewes. These he can mate with a purebred ram, the breed depending largely upon the type of ewe in his flock. If they are large and rugged, he will perhaps use a Southdown ram for the purpose of producing a more closely knit, more desirable market lamb. If the ewes are small, an Oxford, Shropshire, or Hampshire will give the offspring more size.

Another factor which Henning emphasizes, and one which has

been given little consideration in crossbreeding, is the use of linebred animals. The best characteristics are concentrated in a linebred animal, and the use of such individuals in the crossbreeding program will insure more satisfactory results. "Recent scientific research has, without doubt, shown that there is a great difference between individuals and between lines," he says.

As secretary of the American Southdown Breeders' Association, Henning is admirably fitted to carry on research in sheep-breeding. He has the best interests of the purebred livestock industry in mind, and it is doubtful whether this information on crossbreeding sheep would be released if he and his cohorts thought for a moment that it would harm the purebred industry and the fine improvement in livestock standards with which purebred breeding has been synonymous over the years.

Turkeys for Rent

ORVILLE THRASHER, four miles east of Torrington, Wyoming, rents out his turkeys (he has 3,000) as grasshopper eradicators. He gets $12 a day wages for the turkeys, and fattens them besides. He says he could have placed 10,000 turkeys mopping up grasshoppers this year if he had had the birds.

The business started last year as a mutual benefit plan, but when 14 farmers called in one day, all wanting his turkeys, he decided there was money in turks.

So he charged farmers $2 a day for 500 grasshopper chasers and went into the turkey renting business. When a farmer wanted a field cleaned of hoppers, he called up Orville instead of the county agent. If it was within three miles, the turkeys went under their own power. Up to 21 miles they were hauled in a truck.

With each lot of turkeys went a herder, tent and portable roost. They camped on the spot day and night until the hoppers were gone.

Calfhood Vaccination for Bang Abortion

Condensed from American Agriculturist

BANG abortion is one of the biggest problems facing dairymen. In recent years an increasing number of dairymen have adopted calfhood vaccination in an attempt to control the disease. Unfortunately vaccination has frequently been used without sufficient knowledge of its benefits and dangers, and as a result, there are cases where more harm than good has been done.

Many facts about calfhood vaccination have been discovered, but some questions have not yet been answered. The New York State College of Veterinary Medicine, at Cornell, has in progress one of the most extensive experiments in the country, and the U. S. Department of Agriculture has also been working on the question of calfhood vaccination.

Briefly, here is the present situation: There is a general agreement that calfhood vaccination provides some immunity against contageous abortion. Many dairymen who have been vaccinating calves are enthusiastic over the results, particularly where the work has been done by a licensed veterinarian who, in addition to doing the vaccinating has been able to steer the owner away from some of the dangers.

There is a growing feeling that the man who has decided to use calfhood vaccination should have all of the information available, even though at the present time it is incomplete. Here are some important rules for this man to follow:

1. *A herd should have a blood test for Bang Abortion before any calves are vaccinated.*

A blood test will tell the dairyman where he stands and how much abortion, if any, there is in the herd. If the herd is clean, and many herds are, the man is just flirting with disaster to start an indiscriminate program of vaccination.

2. *Only animals under eight months of age should be vaccinated.*

On older animals the treatment is ineffective. Vaccinating a producing cow will cause her to react to the blood test and may cause her to abort. Indiscriminate vaccination of all animals in a herd is most apt to be done after a serious outbreak of abortion in the herd. Even if nothing is done, these outbreaks usually taper off, and if the entire herd has been vaccinated, a dairyman is prone to give vaccination the credit when, as a matter of fact,

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he has been merely piling up future trouble. *For emphasis, we repeat that no animal over eight months old should be vaccinated.*

A calf vaccinated before it is eight months old will react to the blood test for abortion, BUT IN MOST CASES the reaction becomes gradually less and disappears by the time the animal is eighteen months old. Unfortunately, there are a few animals where the reaction does not end. The animal continues to react and must be disposed of. The reaction may persist as a direct result of the vaccination, or it may indicate simply that the vaccination was not entirely effective and that the animal has picked up a natural infection which causes the reaction.

3. *Do not waver back and forth between vaccination and a blood test.*

A blood test gives the necessary information on which to base intelligent use of calfhood vaccination, but there is nothing to be gained by blood testing for a few years; then vaccinating for a few years with no blood tests; and then again going back to a blood test program. With certain restrictions, a man using calfhood vaccination may hope in time to build up a disease-free herd. Vaccination alone will not eradicate the disease. TO GAIN THIS END, IT MUST BE USED IN CONJUNCTION WITH BLOOD TESTS. The reason is that a few animals vaccinated before they are eight months old continue to react for their lifetimes and MAY BE spreaders of the disease.

4. *Bang abortion vaccine should be handled and administered only by a licensed veterinarian.*

No dairyman should attempt to vaccinate animals.

5. *Vaccine should be purchased only from reputable concerns.*

There is a federal law which prohibits inter-state shipment of vaccine except from recommended laboratories, but so far as we know, there is no law in the book effectively to regulate the handling and use of vaccine manufactured within any state.

6. *It is wise not only to employ a veterinarian to vaccinate, but to seek and follow his advice closely.*

At least in New York State, and I believe in most other states, it is possible for a man to practice calfhood vaccination for several years, and then to enlist under the federal-state test and slaughter program, BUT to do this it is necessary to discontinue calfhood vaccination and under the test and slaughter plan to blood test no animals that have been vaccinated (with the intention of receiving indemnities) for eighteen months after the vaccination is received.

In New York State about 3,600

herds, containing some 90,000 cattle, are under official supervision for the eradication of Bang abortion, and the best possible estimate indicates that about an equal number of herds have been tested privately. That is a real start, but after all it is just a start. If the eradication of Bang abortion is to be handled somewhat along the line followed in TB eradication, the problem must be faced and the job should be pushed and completed within a reasonable period. The per cent of Bang abortion infection in most areas is only about half as high as was the case with TB. Therefore, the total cost of eradication of Bang abortion might be about half the cost of eliminating TB which, in the case of New York State, ran better than $60,000,000. Added to that cost are the staggering losses suffered by dairymen who tried to produce milk with sick cows.

If uncontrolled calfhood vaccination becomes common, or we might say nearly universal, then it follows that we must resign ourselves to living with the disease rather than attempting to eradicate it.

The State of Vermont has recognized calfhood vaccination in some new legislation. The law provides for a free initial blood test, after which the dairyman can decide which of four plans of Bang abortion control he would like to follow. Following is a brief summary of the four plans:

A. He can dispose of all reactors to the blood test to other herds known by blood test to be infected.

B. He can maintain two separate herds—one a reactor herd and one a clean herd until he thinks it is feasible to dispose of the reactors to other herds known by test to be infected.

C. He can vaccinate all calves before they are eight months old and dispose of all reacting animals over eighteen months old to other herds known to be infected.

D. He can follow the federal-state test and slaughter program and get indemnities.

Under plans A, B and C no indemnities are available. It remains to be seen how this plan works out. If it is successful, it is probable that something along that line will be adopted by other states.

Sowed Pasture Mix

Condensed from Capper's Farmer

A. J. Brewster

A THREE-CROP mixture makes the best and most dependable pasture, Charles Bruene asserts. He has been using it in Ida county, Iowa, upwards of 20 years and not in that time has he been without grazing. The combination, sowed every spring, consists of 2½ bushels of oats, 3 pounds rape and 10 pounds of sweet clover an acre.

"That supplies pasture longer than anything I've ever tried," he declared, "a succession on the same field, under 1 fence, from corn planting time, when the oats are ready, until Christmas. No permanent pasture in this section will endure as long or carry as many head an acre. I wouldn't trade it for any stand of bluegrass that ever grew."

"As the oats are grazed off, the sweet clover develops accordingly. By the time they are gone in July, it is up 10 inches and supplying all the feed my cattle can take. Removing the cover gradually, as in grazing, insures a better stand of clover in unfavorable years, because it has a chance to harden and competition of oats is removed as more moisture is needed by the seedlings. Rape comes on in midsummer in the clover and flourishes, especially during the fall.

"Sweet clover is drouth resistant, as everybody knows, once it becomes established. Packing resulting from grazing the oats off seems to hasten its becoming established and to make it hardy. But rape is even more drouth resistant as our two worst seasons, in 1934 and 1936, demonstrated. I have a 5,000-bushel crib that has been filled every season, except those two, since 1907. In 1936 it was so dry I didn't even get my seed corn back, too dry even for sweet clover as it had been in 1934, but the rape supplied pasture both seasons. The 3-seeding combination is hard to beat. I don't know anything else that would have made pasture in those years or which would have given as much grazing since the drouth cycle began in 1930. Bluegrass, the standby of this section, failed miserably."

Mr. Bruene makes some kind of seeding in all small grain. From 50 to 60 acres of the mixture is sowed annually. Then where grain is to be harvested he sows sweet clover or, if the field is to be cropped the following season, he adds rape, as little as a

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pound to the acre. That insures grazing if needed in the stubble fields, and particularly for weanling calves purchased in fall for wintering. Some of the clover is plowed down May 1 ahead of corn and some left for seed.

Hereford weanlings are received in fall and graze remnants of the mixed pasture or rape in stubble until freezing weather. They are wintered on corn fodder, alfalfa hay and cottonseed meal, primarily. The fodder is ground and an allowance offered which will average about five pounds of grain a head for the period. A heavier feed is given during coldest weather.

By May 1 when oats in the mixed pasture is ready to graze, the calves will have attained a weight of 700 pounds. If old corn is available they are worked gradually on to a full feed. But in the absence of corn to finish them, he delays full feeding until spring barley becomes available.

"I think a lot of barley as a steer feed," he observed. "It usually is considered to be worth 85 per cent as much as corn, but in results I get, it is almost equal. In 1936 I raised no corn and so had none with which to finish the cattle next spring. But I did raise barley. It was worth 50 cents at threshing time. By selling it thru cattle I got $1 for it. Further, if I had delayed until new corn was ready, I would have lost $3 a hundred in selling price of the steers.

"After the calves get started on grain in pasture, I keep it before them all the time in self-feeders. That way they can balance their own ration. I've learned from experience that plentiful grazing of the type provided by the mixture will save about half the amount of grain normally required in dry lot. My calves go to market at about 1,000 pounds."

The mixed pasture fields stand, with whatever cover the cattle leave, until spring to be plowed down ahead of corn. Fall plowing is not practiced because the soil both blows and washes when left loose and barren over winter.

Mr. Bruene maintains no permanent sods. His only pasture is provided by the mixture and by what grazing may be supplied from sweet clover and rape in the other fields.

Lethals

Some 32 different inherited factors causing death at, or soon after birth, have been identified, 12 in cattle. Many of them have been attributed to incorrect ration, etc., but their hereditary cause is proved by the fact that they disappeared following an outcross.—*Ohio Farmer*

Coccidiosis Today

Condensed from American Poultry Journal

Dr. Cliff D. Carpenter

COCCIDIA are perhaps the most universally serious parasites that attack the animal kingdom; the horse and mule are the only farm animals that seem to escape these parasites. Chickens, turkeys, ducks, geese, pigeons, pheasants, and many wild birds, including sparrows, all harbor this minute microscopic parasite, which is so small that a thousand of them laid side by side measure less than one inch.

Each kind of coccidia has its own host and none is able to establish itself in any other animal, at least in sufficient numbers to produce coccidiosis.

Of these seven species of coccidia that attack chickens, only two have been found to be really dangerous. One of these *Eimeria necatrix,* finds the mucous membrane lining of the small intestine a suitable spot to dig into, and, if large numbers are picked up at one time, an acute bloody type of coccidiosis results, or if smaller numbers are eaten, then there is a prolonged chronic form of the disease.

The activity of this parasite in the intestinal membranes ruptures thousands of tiny blood vessels, resulting in a great loss of blood, often fatal. On autopsy, the small intestine is found considerably enlarged and the walls are very thin. Small white areas about the size of a pinhead can be seen in the walls from the outside. Large masses of blood are found in the intestine.

This type is not so widespread and destructive as the acute cecal type which invades the blind pouches and attacks chicks, usually between the ages of 4 and 8 weeks.

The coccidium of greatest economic importance to the poultryman, is called *Eimeria tenella.* This parasite is discharged in large numbers from the ceca of affected chicks and also by hens which may be immune to further attacks of coccidiosis, and known as "carriers." These coccidia find suitable protection in the litter and soil.

For the first day or two, they are harmless, for like any other egg, before they can hatch, they must incubate. Directly exposed to the sun, they are quickly destroyed, but because of the protection of the droppings, most of them escape this punishment, and in a short time

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they are ready to start their life cycle all over again. Other chicks in a given brood may pick up these newly sporulated (incubated) eggs, or these eggs (oocysts) may remain alive but inactive in the soil or litter for many months, and yet be infective when eaten by a susceptible chick a year later.

Within the chick, sporozoites (infective agents) are released from the eggs; they travel the length of the small intestine—30 to 50 inches depending on the age of the chick— where they find their way into the blind pouches, or ceca, and penetrate the lining of the mucous membrane. Here they produce large numbers of other infective forms called merozoites. Large numbers of cells are invaded and tiny blood vessels ruptured, releasing blood which escapes from the walls and becomes mixed with the cecal droppings. The amount of blood seems to be determined by the number of coccidia picked up by the chick during a comparatively short time. If only a few at a time, the chick is not seriously affected, and these mild attacks produce a natural resistance against later and heavier attacks. This increased resistance is called "natural immunity," and it is this phenomenon which undoubtedly avoids wholesale catastrophies in the poultry industry from this parasite.

When the poultryman first sees coccidiosis, he may notice a loss of appetite, ruffled feathers and paleness of the head region. If, on the other hand, a mass dose of say 100,000 incubated coccidia eggs (oocysts) is picked up by a susceptible chick within a short space of time, perhaps over a period of one to three days, then the first evidence of coccidiosis is bloody droppings. In the milder attacks, the chick may linger several days or several weeks, finally wasting away and dying. In the case of acute type, however, death may occur from loss of blood within 24 hours after the first blood appears in the droppings.

Beach, of California, did much of the early work in coccidiosis control. His recommendations of twenty years ago included removing the mash and drinking water, and giving only grain and buttermilk for one to two weeks. He suggested changing the litter daily, and, since the bloody droppings are not infectious the first twenty-four hours after they are expelled, this routine largely limited further infection.

Not long afterward, mashes containing as much as 40% dried skim milk or dried buttermilk were introduced to the poultryman, replacing the liquid buttermilk and grain. Contrary to popular belief, the milk did not fight coccidiosis by the production

of lactic acid, but merely sustained life during the critical 10-day period that the coccidia remain active within the chick.

The next great step in coccidiosis control came with the production of dried cheese whey, a substance from which the milk proteins had been largely extracted, but which was very high in lactose, or milk sugar. This product fed in the mash in proportions considerably less than 40% overcame detrimental effects caused by forced growth and retained the appetizing, nutritious benefits.

About three years ago, the University of Wisconsin published a preliminary report on the value of flowers of sulphur when fed in the mash from two to ten per cent, in preventing and curing coccidiosis. Herrick and Holmes of that station concluded that sulphur was of no value to the already infected chick, but when fed for several days to several weeks before infection, would protect against mass doses of 100,000 or more sporulated *Eimeria tennella* oocysts. They concluded, however, that flowers of sulphur sufficiently interfered with normal growth so that serious results followed any prolonged feeding of this apparently inert drug.

The writer compared flowers of sulphur, sulphur flour, and aqueous colloidal sulphur in their effects on growth and the comparative protection against artifically administered doses of coccidia. The result showed that sulphur flour, which is finer than flowers of sulphur, gave better protection than flowers of sulphur in the same quantity, but more seriously affected the physical condition of the chicks. The colloidal sulphur in liquid form, fed in the drinking water, could not be given in large enough quantities to be effective, but when three per cent (a ten per cent solution) was added to the mash for five days before the chicks were infected, protection against doses of oocysts up to 25,000 was granted. However, more work needs to be done under field conditions before the product can be recommended.

Since coccidia are parasites, they spend a limited time within the chicks which they affect. Consequently, losses from an attack of coccidiosis depend upon: (1) the number of chicks affected in the beginning, (2) the number of coccidia each affected chick has eaten, (3) the early diagnosis of the disease, (4) removing the birds from the source of infection, (5) isolating or destroying the sick birds, (6) proper nursing and care during the ten days following the first evidence of the attack.

Often the disease may be diagnosed when only a few chicks show symptoms earlier described. Using proper measures promptly results usually in a limited loss.

After chicks are three weeks of age, poultrymen should be on guard constantly for the next five weeks for evidence of coccidiosis.

Since coccidia live over from one year to the next in the soil, chicks should be brooded on ground that has not been used for either chicks or hens for at least two years, nor should any poultry manure be used on this ground during this two year period. Such procedure guarantees that every coccidia egg will be dead, thus eliminating the chief source of infection. The brooder house should not be too close to the hen house or other places where adult chickens may run, since coccidia oocysts may be tracked from the hen house litter and yards over to the brooder house. Where practical, the person caring for the brooder house should not contact older birds. A pair of overshoes or rubbers may be placed at the brooder house door and used only by the person caring for the chicks, and left at the door upon leaving. Visitors should not be permitted inside the brooder house or yards.

If the brooder houses are not movable and clean ground is not available, chicks may be confined to a sun porch made of heavy hardware cloth, cement, or boards, but if any solid material is used, it should be kept as clean as the brooder house itself.

Coccidiosis is not an inherited disease. Even when oocysts were placed in the egg shells at the time of incubation, infection of day-old chicks did not occur from this source. After the brooder house has been scraped, swept, scrubbed, and scalded with a hot lye solution and clean litter placed on the floor, you have given the birds a good start without exposing them to the hazards of coccidiosis.

Any chick that is out of condition between the ages of 3 and 8 weeks should be killed and examined for evidence of coccidiosis in the ceca. Fresh unclotted blood, mixed with cecal material may be in evidence, or if the chick has not eaten enough coccidia to produce a large volume of blood, one may find very little blood mixed with a grayish-white mucus, often in the form of a plug, which in severe cases may fill the entire cecum. Or, with a sudden attack there may be no droopy chicks, in which case watch out for evidence of blood in the litter and on the mash hoppers. If there is any doubt, several suspicious looking chicks should be examined by one qualified, or sent to a laboratory for examination.

If coccidiosis is diagnosed, chicks should be confined to the brooder house. If the cockerels have not been removed, separating them at this time is of great assistance in controlling the disease. All chicks showing signs of

the disease should be removed to separate quarters or killed, since most of them discharge large numbers of oocysts.

From years of observation, best results seem to be obtained by removing the regular chick ration and feeding nothing but a flushing mash for an entire day. Allow plenty of water and keep the chicks warm, permitting, of course, adequate ventilation. The next morning, the litter should be removed and the floor swept. Replace a small amount of litter, just enough to keep the floor dry and warm for a day or two. This second day, the chicks may be fed their regular chick starter. The third day, feed the flushing mash again, but for a half-day only, giving the regular starter in the afternoon. On the morning of the fourth day, change the litter again and feed regular mash for that day. The fifth day, use the flushing mash again, but only for two or three hours. If these steps are carried out in detail, coccidiosis seldom becomes unmanageable.

Pig Brooders

Condensed from Electricity on the Farm

J. P. Schaenzer

Agricultural Engineer, Edison Electric Institute

IN 1932 members of the staff of Oregon State Agricultural College decided to construct a brooder designed exclusively for pig brooding. Their early efforts were spent in developing a hover with an underheat type of electric element.

Preliminary tests of the electric brooder with pigs farrowed in December and January seemed to indicate that larger litters were weaned than when none was used. The small pigs stayed under the hover to keep warm and fewer of them were crippled or killed by the sow. Perhaps due to the mild March weather of 1933, experiments with twelve sows and their litters did not show any advantage in the per cent of pigs raised (about 80) to eight weeks of age when using equipment. Of real significance, however, those pigs raised with the brooders weighed an average of 29.5 pounds each at 56 days of age, and those not so raised, 25.2 pounds. This is an increase of 15 per cent in weight.

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Further experiments with electric pig brooders were carried on at the University of California during the springs of 1935, 1936 and 1937. During these three years the pig losses for the first ten days averaged 29 per cent in the regular farrowing pens where no supplementary heat was used. North Dakota Experiment Station reports a loss of 30 per cent, and Nebraska records of 159 litters show that mature sows raised only 60 and young sows 76 per cent of the pigs farrowed.

For these same years underheat brooders were used on nineteen litters in California with a loss of only 15 per cent. A homemade hover equipped with an incandescent lamp of either 100 or 150 watts to furnish both heat and light was tested on thirteen litters. With this radiant type of pig brooder only 13 per cent of the pigs were lost. In other words, ten days' use of electric pig brooders reduced losses to about one-half.

Hovers are built out of wood, triangular in shape so that they fit into a corner of the pig pen. The two sides are made of twelve-inch boards, three and one-half feet long, and nailed together at right angles. Lumber or insulating board may be used for the top. To give it strength a 2x4 is placed across the top of the front, leaving an entrance about eight inches high.

As a heating element, a white-enameled dome reflector, twelve or sixteen inches in diameter, should be installed with a 100- or 150-watt lamp. A hole one-half inch less in diameter than the reflector is cut in the center of the top and the reflector placed over it and fastened in place. A strong wire nettng should be fastened to the underside of the hole to protect the lamp and reflector. The unit should be equipped with waterproof rubber cord for safety and durability.

The brooder should be fastened securely in the corner to prevent the sow from damaging it. A two-foot barrier of boards or planks placed above the front of the hover will help to protect it.

Experience has shown that it is advisable to place the sow in the pen in advance of farrowing time. The brooder should be started shortly before the arrival of the pigs. It will be necessary to place them under the hover by hand until they learn to go there by themselves. Blocking them in for several hours will help train them.

The electric bulb type heater has the advantage of supplying both heat and light, and it is an easy matter to reduce the heat output by installing a smaller size of lamp. With a 100-watt lamp, the energy consumption will amount to twenty-four kilowatt hours for each ten days of brood-

ing with the lamp on continuously. Because of the short brooding period per litter, it is possible to use each hover several times throughout the farrowing season.

Prices received by farmers for hogs per one hundred pounds range from a low of $6.38 in December to $8.02 in September. A 200-pound hog sold in September will bring on an average $3.28 more than if marketed in December. Spring hogs are highest in March. These figures are ten-year averages, 1928-1937, published by the Bureau of Agricultural Economics, U. S. Department of Agriculture. The average prices for all months were:

January	$6.67
February	6.88
March	7.14
April	7.06
May	7.00
June	7.08
July	7.50
August	7.91
September	8.02
October	7.33
November	6.69
December	6.38

Hogs sold during August or September must be farrowed in February or early March. In most sections of the country these are cold months. The mortality among young pigs is higher than the average. Warm quarters must be provided. The electric pig brooder can be of practical value. It will not only save a larger number of the pigs, but also enable the farmer to get them ready for the highest priced market of the year. As more pigs are raised per sow, it is also possible to reduce the cost of production by holding over less breeding stock. This may result in a substantial saving in labor, feed and shelter cost.

Ground limestone has great possibilities for the cattle feeder who finds difficulty in producing or procuring alfalfa. Bell, at the Ohio Station, showed timothy, fortified with .8 lb. ground limestone and .6 lb. linseed oil meal, to be almost equivalent to alfalfa for breeding ewes. At the Kansas Station .1 lb. ground limestone added to a ration of corn, cotton seed meal and silage was equal to 1.98 lbs. of alfalfa in the ration for feeding cattle. At the Oklahoma Station .17 lb. ground limestone added to corn, cotton seed meal and five lbs. prairie hay increased the rate of gain and reduced the cost of gain of fattening cattle.—*Ohio Farmer*

Vitamin D Products for Poultry

C. S. Platt

Associate Poultry Husbandman, N. J. Exp. Station

Walter C. Russell

Biochemist in Nutrition, N. J. Exp. Station

VITAMIN D is now commonly supplied in poultry rations by fish liver oils and fish liver preparations. Cod liver oil and preparations from it are probably the most widely used, but other fish liver oils are also on the market. Cod liver oil is sold as the natural or straight oil and as a fortified product. The former is the oil as it has been rendered from the liver of the cod whereas a fortified oil is one whose vitamin D potency has been increased by the addition of a concentrate of vitamin D prepared from another fish liver oil or by the addition of a high-potency natural fish liver oil or a synthetic vitamin D. In some instances the high potency vitamin D product is added to solid material or is put into a watery medium, such as molasses, instead of to an oil.

Upon cooling cod liver oil a solid material known as stearin is settled out. The remaining oil is sold as a "destearinated" oil. If the stearin has not been removed, the oil is referred to as "non-destearinated." If an oil of the latter type is kept at a low temperature, as during winter storage, it should be brought to room temperature and thoroughly mixed in the storage container before it is withdrawn for use.

Research of recent years has shown that there may be six or possibly eight different vitamins D. Certain of these are not as effective as others in the prevention of leg weakness and the promotion of egg production in the chicken, but generally speaking the fish liver oils and fish liver oil preparations now on the market contain the types of vitamin D which are effective.

The vitamin D potency of a fish liver oil or concentrate is expressed in units and is determined by comparison with a reference cod liver oil of known potency, according to an established procedure, in which the white rat or the chick is used as the assay

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animal. The reference oil contains 95 U. S. P. (United States Pharmacopoeia) units per gram. In the case of cod liver oil for poultry use, the vitamin D potency is now determined according to a tentative procedure established by the Association of Official Agricultural Chemists and the vitamin D value is expressed in terms of A.O.A.C. (Association of Official Agricultural Chemists) units. This unit is equal to the U.S.P. unit in the case of most fish liver oils. The U.S.P. unit is sometimes referred to as the U.S.P. XI unit because it is defined and the assay procedure described in the XIth Decennial Edition of the U.S. Pharmacopoeia.

The reference oil mentioned above is used solely as a standard for comparison and is not to be confused with the term U.S.P. cod liver oil which is an oil containing not less than 600 U.S.P. units of vitamin A and not less than 85 units of vitamin D per gram. (After July 1, 1940, the minimum value for vitamin A will be 850 units).

Various grades of cod liver oil are on the market, but any product bearing the label "U.S.P. cod liver oil" must contain not less than 85 units of vitamin D per gram. Oils containing less than this number of units cannot be legally labelled U.S.P. Some cod liver oils contain considerably more vitamin D than the minimum U.S.P. requirement, in some instances as much as 250 units per gram.

Although there are many brands of fish liver oils and preparations made from them on the market, any of them should be satisfactory for poultry feeding as far as the type of vitamin D is concerned. Since the vitamin D content of these products can be expressed in units per gram, the buyer is now in a position to insist that the firm selling the product guarantee a minimum vitamin D potency in terms of U.S.P. or A.O.A.C. units. Furthermore if the potency is expressed in another kind of unit or in some other manner, the buyer is justified in requiring the results of an assay in U.S.P. or A.O.A.C. units. Numerical factors should not be used to convert other units to the U.S.P. or A.O.A.C. units.

Stability of vitamin D in the product before it is mixed with the feed and after mixing with the feed should be given consideration. Generally speaking, vitamin D is probably stable in the presence of an oil. If the product is not an oil or does not contain an oil, the firm selling the product should be required to furnish ample evidence as to the stability of the vitamin in the form in which they offer it for sale.

A product should be purchased on the basis of the number of

units a dollar will buy. There is nothing mysterious or magic about an oil whose potency has been increased by the addition of more vitamin D in order to fortify it or a solid material to which a vitamin D preparation has been added and a premium should not be paid for them. Hence the poultryman should be in the market for the largest number of units of a reliably assayed, stable product that he can get for his money.

If a product carries vitamin A so much the better. However, since yellow corn and green plant tissue supply vitamin A and since none of the common feeds provide vitamin D, a buyer's attention should be directed toward the latter factor. Although not as stable in mixed feeds as vitamin D, the vitamin A of fish liver oils, generally speaking, does not decrease in potency in significant amounts during a month and probably not during even two months. At least any decrease in potency is not serious.

With the best possible vitamin carrier obtainable, there is still the problem of feeding it in such a manner that each bird in the flock will get a proper share, and the first essential in this respect is to insure a uniform distribution of the vitamin in the feed to be used. As the vitamin-carrying material generally is mixed with the mash portion of the feed, its uniform distribution can be accomplished best by the use of a "premix," or the practice of mixing the vitamin product first with some ingredient to be used in the mash, such as wheat bran or coarsely ground oats. After this has been accomplished, the other ingredients to be used in the mash may be added to the mixture with some assurance that the vitamin will be well distributed throughout the feed. In addition to this precaution to insure a proper intake of the vitamin on the part of every bird, consideration must be given to the amount of mash consumed. A ration consisting of both grain and mash requires a higher content of the vitamin in the mash than one where no grain is fed. In some instances the practice has been followed to purchase a feed intended for use on an all-mash system of feeding, and then supplement it with grain. This invariably results in vitamin deficiency in the flock, no matter how potent the vitamin carrier may have been or how well it was mixed. The mechanical aspects of feeding the vitamin supplements are just as important as their unit values, and must receive due consideration.

The recommended quantities of a vitamin D supplement containing 100 U.S.P. or A.O.A.C. units per gram indicated in the table will meet the needs of chickens under most conditions.

Pounds of Vitamin D Products Containing 100 U.S.P. or A.O.A.C. Units Per Gram to be Mixed with One Ton of Mash for Chickens Not Having Access to Direct Sunlight

Purpose of Feed	When Fed as an All-Mash Ration	When Fed with Grain
Starting Mash	10 pounds	20 pounds
Growing Mash	10 pounds	20 pounds
Laying Mash	20 pounds	40 pounds
Breeding Mash	20 pounds	40 pounds

Note: These quantities can be reduced one-half if the vitamin product contains 200 units per gram, and one-quarter if it contains 400 units per gram.

An exception may be noted in flocks bred for more than average egg production. Their need for a greater quantity of vitamin D will be indicated by the quality of shell texture, and when egg breakage becomes excessive the amount of the vitamin should be increased by one-half. As cod liver oil will flavor the meat of fowls it should be removed from the diet 3 weeks prior to marketing.

Recommendations for Turkeys

The requirements of turkeys for vitamin D, especially during the first eight weeks of growth, are greatly in excess of those of chickens, actually being four times as much. Thus with a vitamin-carrying material containing only 100 U.S.P. or A.O.A.C. units of vitamin D per gram, the quantity added to a ton for an all-mash feed for turkeys would be 40 pounds; and when grain is to be fed, the amount of the vitamin carrier would need to be increased to 80 pounds. If cod liver oil were the carrier being used, this quantity would be detrimental to the bird. For this reason, the more potent sources of vitamin D should be used in turkey rations or the birds permitted to have access to direct sunlight. The requirements of turkey laying and breeding stock are not known, but general practice indicates that the quantities used in laying and breeding mashes for chickens will be satisfactory for turkeys. Cod liver oil should be removed from the feed for a period of 10 weeks prior to killing to avoid the flavor of the oil in the meat.

Increasing the Milk Production of Institutional Herds

Condensed from Holstein-Friesian World

A. L. Beam and C. S. McLearen

The Pennsylvania State College

THERE has been a substantial increase in the production of milk in some of the state institutional herds during the last few years but the increase has not been uniform among all state herds. A study was made to determine the reasons for the different levels of milk production in fourteen institutional herds with the hope that the additional information obtained might be of general value to dairy farmers.

About 1200 Holstein cows were included in these institutional herds at the time the survey was made. The size of the herd varied from 21 to 145 milking cows. All herds are entered in Dairy Herd Improvement Associations and uniform management records covering milk production, feed consumption, and breeding data are kept by each herdsman.

The production of milk for the herds as a whole has been increased from 9,000 pounds in 1929 to over 12,000 pounds in 1935. Since 1935 the average yearly milk production for all herds has not been less than 12,000 pounds. During the last six years the average production among these fourteen institutional herds has ranged from 9,720 to 16,667 pounds of milk.

A few of the more pertinent factors which seemed to have some influence on increasing and maintaining milk production are discussed briefly in this paper.

Data from other sources have shown that cows which freshen during the fall and winter months have an advantage in milk production over those cows which calve during other seasons of the year. It is interesting to note that in the highest producing herd among the state institutions 69.2 per cent of the cows have dropped their calves during the fall and winter months. This covers a period of six years, 1933 to 1938 inclusive. In contrast to these figures it was found that only 46.5 per cent of the cows in the lowest producing herd freshened during the fall and winter months.

In order to maintain milk pro-

Reprinted by permission from Holstein-Friesian World, Laconia, N. Y., Jan. 6, 1940

duction during the summer months soilage crops have been fed to supplement pasture in the herd ranking highest in production.

Each state institution can readily dispose of animals culled from its dairy herd by using the animals for meat. This acts as an incentive to cull low producing cows. On the other hand, some institutional herds can not supply enough milk to meet the growing needs of the inmates and this encourages the keeping of all cows regardless of the amount of milk they produce.

In the herd ranging highest in production, close culling is practiced and a herd average of 600 pounds of butterfat has been set as the goal with three milkings daily. This institution has a large number of heifers from which to select milking cows, as 59.2% of the total number of females in the herd are under freshening age. This same institution also supplies replacements and additional animals for other herds after the most promising individuals have been selected for its own herd.

In those institutions where there is an increasing demand for milk the dairy herds are being enlarged by raising all female calves and by securing additional heifers from similar institutions. This means that little if any culling can be practiced until the demands for milk have been met. It also results in some herds having more young stock on hand than good management practices would indicate were necessary under normal conditions.

The absence of disease and breeding troubles in a herd largely influences the extent to which culling can be practiced. In one herd where considerable trouble has been experienced with Bang's disease, white scours and mastitis, calf mortality has been high, milk production has been lowered greatly and culling has been kept to a minimum. The average production in this herd has been 4,265 pounds of milk lower than the herd ranking highest in production during the past six years. This herd also has the lowest percentage of young stock in comparison with the number of milking cows and as a result it is difficult to carry out judicious culling. Of the total number of females in this low producing herd, 38.7% are under freshening age as compared to 59.2% of young stock in the herd ranking highest in production. In the fourteen institutional herds studied an average of 48.6% of the total number of females in the herds were below the age of freshening.

There are four common methods followed in securing bulls for use as herd sires in institutional herds. They are:

(1) By raising a bull calf from an outstanding cow in the herd.

(2) By exchanging animals, foodstuffs or some other commodity for a bull from another state institution.
(3) By leasing a bull (usually a proved sire) from the Federal Government.
(4) By purchasing a bull from some privately-owned herd.

Pedigree and the type of the animal and its relatives usually form the main basis for selecting a bull for use as a herd sire. Neither of these factors gives any certain indication of the genetic make-up of the animal nor what production factors it may transmit.

One outstanding example of the uncertainty in purchasing bulls on the strength of their pedigrees was found in two institutions which had secured bulls of closely related blood lines.

The one bull was line bred, a grandson of King of the Ormsbys having been bred to a daughter of the same bull. The pedigree was very attractive from the standpoint of production records. This bull sired 15 daughters, the average of whose records was 20,486 pounds of milk when figured to a mature basis.

The dams of these daughters averaged 16,665 pounds of milk resulting in an increase of 3,821 pounds of milk for the daughters over the production of their dams. This gave the sire an index of 24,307 pounds of milk as determined by the rule given in Vol. 9 of the Red Book. "If the daughters average more than their dams, the difference is added to the daughter's production in determining the sire's index."

The other bull was inbred being a double grandson of King of the Ormsbys with Spring Brook Bess Burke 2nd appearing four times in the first three generations. This pedigree carried more production records than the one just mentioned. This second bull also sired 15 daughters whose average production was 11,808 pounds of milk. The dams of these daughters produced 13,787 pounds of milk, resulting in a decrease of 1,979 pounds of milk for each daughter. The second sire had an index of 9,829 pounds of milk.

From a study of the pedigree alone the last bull mentioned seemed to have greater possibilities. He had been used earlier in a herd where he sired seven daughters all of which together with their dams had A. R. records. All but one record on the daughters and one record on the dams had been made as Senior two-year-olds. When converted to maturity the daughters averaged 10,886 pounds of milk and the dams had an average of 19,095 pounds. This gave the sire an index of 2,677 pounds of milk. Had this bull been selected on the basis of performance rather than

pedigree he would not have been chosen to head an institutional herd but records on his first daughters were not available at the time he was purchased.

The age of first freshening of heifers ordinarily influences the rate of milk production providing environmental factors are similar.

The age at which heifers are first bred in institutional herds ranges from 18 to 23 months and the actual freshening age runs from 27 to 32.9 months. In both cases the variation is nearly 6 months. Age at first freshening apparently has little or no effect on yearly milk production in the herds studied because of the influence of other factors. In the herd with the highest yearly production late breeding is practiced regularly and in another herd late breeding is not intentional but results from breeding troubles. The difference in production between these two herds is 3,437 pounds of milk each year for a period of six years. This increase in production can not be attributed solely to increased size of heifers since the higher producing herd has been unusually free from disease, close culling has been practiced, and bulls with high milk indexes have been used.

In another herd, which ranks second in production, the heifers are bred to freshen at 27 months of age. Lower milk production in this herd due to any lack of size is offset by freedom from breeding troubles, very close culling and the greater care given the individual animals.

Evidently, the late breeding of heifers will not necessarily result in greater milk production usually associated with increased size of animals unless they are free from disease and good management practices are followed.

Management Practices Followed in Highest Producing State Institutional Herd

1. Sires selected on basis of pedigree study. This method is not as certain as the use of proved sires.
2. Calves given very good care and heifers well grown before breeding.
3. Cows milked three times daily by good hand milkers.
4. Cows well bedded and liberally fed with mixed hay, corn silage and 18% grain mixture. Pasture in summer supplemented with silage crops.
5. Herd free from disease. Very few cases of mastitis. Stall platforms kept clean and dry.
6. Production standard set for the herd. Careful culling is practiced.
7. Nearly 70 per cent of cows freshen during fall and winter months.

Barracks House

Condensed from Everybodys Poultry Magazine

Byron Clark

IF anyone told you that you could get 17 months of profitable production from your pullets, what would you say? For one thing, you'd say, "how"—and next, you'd probably say "where."

The barracks system has been used in several states for molting old hens, for summer trapping, and for early pullets. But most barracks houses are pretty sketchy, built as large summer shelters and not much else. Here is a story about a new type of barracks house, an all-purpose building built to stand for years and to serve a dozen uses. It's a house that could be used on every poultry farm; the facts on its use prove that it has been profitable.

Mount Fair Farm of Connecticut is not a "fancy farm." It has a dairy department and a poultry department, and is owned by S. McLean Buckingham.

The poultry department at Mount Fair is under the direction of W. C. (Cliff) Peck, who was trained as a poultryman at the Storrs Laying Contest. Mount Fair is first of all a paying commercial poultry farm, and besides that it is an R.O.P. pedigree breeding farm. I've made this point because the barracks house is something that can be useful to every poultryman, and not just to a breeder.

The chicks to be raised for flock replacement at Mount Fair Farm are always hatched early—in January and February. Consequently, Cliff always has the problem of keeping his pullets from molting in the fall. He also had the problem of what to do with his hens, until he built the barracks house. The house was finished this last year.

In the first week of June, 1939, they moved 700 laying hens into the house. The hinged sides were opened up, nests and roosts and dropping pits had been installed, and Cliff waited for production to drop. Instead of that, those hens that had been laying for 13 months, and acted as if they'd had about enough of it, increased their production. They laid at about 60 per cent until August, when they started to slip a little. Production continued to drop gradually; so in late September with a pretty good market for hens, they let the whole bunch go.

Since most of these hens had

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been producing for 13 months when moved, Cliff was able to get 17 months of profitable production out of his birds before sending them to market.

Before putting in the 700 hens, the house had been used in the spring of 1939 to hold 700 pullets that were about ten weeks old, previous to sending them out on range. After the hens went to market, the house was cleaned out in October and the sides lowered for winter. It has been equipped with auxiliary heat, and in December was filled with chicks under electric brooders.

The house could also be used for finishing off broilers, for molting hens in the Fall while the other houses are being cleaned, and for that bunch of May or June hatched pullets that you might raise to fill out your production. Such a house would fit nicely into a program which includes Fall-hatched chicks. In other words, it's an all-purpose house which rounds out the chicken farm and makes it possible to get a lot more use out of both birds and buildings.

There are many interesting things about the construction of this barracks house, departures from standard poultry houses which make possible the wide variety of uses. Most unusual, of course, are the hinged sides. Three sides are hinged at the top and left up, so that there is almost half again as much shade and shelter from weather as is available in any range shelter or brooder house.

Basically, the house has many of the features of the standard Connecticut type laying house, with controlled ventilation and cold air intakes.

Outside measurements are 24 by 50 feet, with the long side facing South. There is a cement floor, made up of 3 inches of rough cement and 1 inch of finish cement, trowelled smooth. The trenched foundation is 42 inches deep, and rises 1 inch above the floor as a base for the sills.

Framing throughout is well-braced and substantial because of the large size of the building, with 4 by 6-inch sills and 6 by 6-inch corner posts, which are 57½ inches high. Plates are three 2 by 6's on top of each other; the back wall has five posts, plus the corner posts, all 6 by 6 inches. End plates lap on side plates. The doors are hinged from the plate and swing up in line with roof in back. The walls on the side swing up higher than those in the rear, thus giving head room to walk under. There is a door for winter use in the middle panel of the west end.

Siding is 4-inch fir flooring laid in paint. Framing of the wall panel doors is 2 x 3 inches. There is an 8-inch pitch to the roof, which has paper shingles. Ceiling joists are 2 by 6-inch, 2 feet on

center; the attic is floored for storage, with about 4 feet clearance in the center. The ceiling joists are tied to the ridge pole.

The front, or South, wall is in most ways like those in the Connecticut 24 by 24 house, with a double wall, a false plate in front to allow for the controlled ventilation. The windows are 6-light 10 by 12 sash, set in batteries of two. Ceiling height inside is about 6 feet, 6 inches.

When equipped for laying hens, there were feed hoppers outside, all around the building, as well as feeders inside. A battery of nests three high facing front and back provided egg laying quarters. Droppings pits were used, 20 inches deep, with regulation Connecticut type roosts, built in sections 4 by 8 feet and resting on two by twelves, well braced.

Aside from their extensive breeding program and their stressing of hen-housed flock averages in their published records, Mount Fair is conspicuous for its common-sense poultry management. Feeding, cleaning, marketing, and culling have all been studied carefully from the management standpoint.

This barracks house is one of the results of this study of their own needs. Most poultrymen would find such a house a solution of several of their problems.

Timothy

Tests have shown that Marietta—new variety of timothy developed at the North Ridgeville, Ohio, timothy-breeding station—yields more than ordinary timothy, especially in the latitude of southern Ohio. In comparison with ordinary timothy, it is ready to cut for hay at more nearly the same time as medium red clover or alfalfa. Marietta Timothy is being introduced in those areas to which it is well adapted.—*G. R. F., Successful Farming*

Big Dividends in Moderate Stocking

Condensed from The Hereford Journal

George F. Ellis

Extension Animal Husbandman, State College, N. M.

SINCE the beginning of the cattle industry in the Southwest, ranchmen have prided themselves on their skill in handling cattle. Perhaps no group of men anywhere in any business has been more expert in their line than have Western cattlemen in handling large numbers of cattle under range conditions. They also have been well known for their ability to look at any large bunch of cattle and size them up accurately as to weight, quality and condition.

These phases of the business have received careful attention and study in the past. However, within the last few years, a new phase of the ranching business has forced itself to the attention of range livestock men. They have come generally to realize that they must face the problem of getting the largest possible return from their grazing lands, and so must study more intensively the business of managing the range itself.

Since the open-range days the trend of the livestock industry in the West has been toward higher cost of production. Land has been a little harder to get each year and purchase prices, as well as leases, have risen steadily. This competition for grazing land is very keenly felt among Southwestern livestockmen at this time.

A cow on a western ranch not only has to pay interest on the money invested in her, but she has to show a profitable return on a large investment in the land on which she grazes. On top of all of this, all of the cash operating expenses on the range have increased, so that the ranchers at present are seriously concerned with the problem of getting more return from their lands. The question is how this can be done.

Some studies conducted by the New Mexico Experiment Station, under the direction of Prof. J. H. Knox, and carried to the ranchmen in New Mexico by the extension service, have proved of interest to livestock producers in this connection. These studies have dealt with the effect of the rate of stocking on the production of beef. By a plan of conservative stocking, cows have been produced weighing 1,035 pounds when their calves are weaned in

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the fall. These cows have been averaging a 90-percent calf crop and the calves have been weighing 449 pounds on the average. This has been done on a ranch where the average rainfall is only 8½ inches and where no cake or other supplemental feed is used. Native range grass, our cheapest feed, has produced all the beef.

In these studies the pastures have been stocked about 15 percent below their estimated carrying capacity which means that they are carrying seven to ten head per section. It is interesting to compare the production of beef under this plan with the production on some ranches in the same section. Surveys made in the state a few years ago show that on many ranches wet cows only average 750 pounds in weight at calf weaning time. On such ranches the average calf crop is about 50 percent and their weight runs about 320 pounds on the average.

We believe that such differences in weights and beef production can only be explained by the difference in rates of stocking. Production from the experimental cattle seems to be about normal and means that they are getting an ample supply of feed. Tests conducted at the Missouri Station proved that when cattle get sufficient feed for normal growth and maximum production, their weights are very nearly the same as those of the cattle on the Experimental Ranch.

The Missouri studies also show that when cattle receive about 30 percent less feed than is necessary to get normal development, the production is about like that on the ranches where the cows weighed only 750 pounds and produced a 50 percent calf crop, weighing on the average 320 pounds. Thus, it becomes evident that on many ranges in the Southwest the cattle are apparently receiving about 30 percent less feed than they should get for maximum production of gains in the form of calves and dry cows.

Of course the pertinent question is, which system will produce the most pounds of beef on any certain ranch? Nutrition studies made under controlled conditions in various feedlot tests show that it takes about the same amount of feed for 100 750-pound cows, producing a 50-percent calf crop, weighing 320 pounds, as it takes for 78 1,000-pound cows producing a 90-percent calf crop, weighing 400 pounds or better. Since this is true, we can assume that if a rancher is producing the lighter weight of cattle he could reduce the number from 100 to 78 and actually produce more pounds of calves.

It takes only simple arithmetic to calculate that 100 cows with a 50-percent calf crop will pro-

duce 50 calves. When these weigh only 320 pounds, 16,000 pounds of beef are produced. On the other hand, if the pasture producing such weights is stocked with only 78 cows they will produce 90 percent calf crop, or 70 calves to market in the fall. If these calves weigh 400 pounds, we get a production of 28,000 pounds of beef. After all, the pounds of beef produced for sale are what count rather than numbers, since practically all of our cattle are now sold by weight.

In addition to the work done at the college, ranchers in all parts of New Mexico have demonstrated that they are able to get more pounds of beef by putting a few less cattle in the pasture.

It is sometimes argued that ranchmen cannot afford to reduce their numbers of livestock, but since it has been proved that they can produce more pounds of calves or lambs or wool by reducing numbers, it seems apparent that they cannot afford not to do so. The reason that the lighter rate of stocking produces larger gains is that a smaller number of cows in a pasture uses less feed for maintenance and leaves a larger percentage of the available feed for producing calves.

Prof. P. E. Neale, of the New Mexico Experiment Station, is authority for the statement that 100 750-pound cows, in a pasture which produces that weight of cattle, will use about 84 percent of the total feed for maintenance alone. This leaves only 16 percent of the feed for production of gain. On the other hand, 78 1,000-pound cows in the same pasture would use only 73 percent of the average feed to maintain themselves and would leave 27 percent to be used for making pounds of beef in the form of calves.

Of course the business of reducing numbers can be carried to an extreme so that efficient use is not made of the forage produced. We believe that every rangeman can learn through experimenting what his rate of stocking should be to get the largest production. When he gets 1,000-pound cows producing 400-pound calves and a 90-percent calf crop, the chances are that he is about right. In fact, the rate of stocking that will produce the largest number of pounds of beef may be the best measure of the carrying capacity of a ranch.

There is another angle from which the rate of stocking should be considered and that is its effect on the grass itself. Numerous grazing studies have shown that a conservative rate of stocking increases the strength and vigor of the plants, as well as the density of the growth. Light grazing has also proved that it increases the volume of the feed produced by a range.

There is another problem with

which all Southwestern rangemen are faced and that is a fluctuating feed supply due to wide variation in the rainfall from year to year. One year may be an exceptionally good one with excessive feed being produced, while the following one may be extremely dry so that a very scant supply of grass is available. Under these conditions the ranchman is faced with the problem of working out some plan of management whereby he can easily adjust the number of his livestock to the amount of grass produced.

In helping to solve this problem, the possibility of keeping steer calves over until they are yearlings is attracting considerable attention. This plan has been studied for the past four years at the New Mexico State College. Even with the kind of production the college has been able to get from breeding cows by its conservative stocking, it has been found that steer calves, when kept over until they are yearlings, produce more pounds of gain from the feed eaten than do cows and calves.

Table I summarizes this production. Steer calves, which have been wintered on the experimental range in the pasture, with no supplemental feed except one-half pound of cake per head per day for 60 to 90 days, and which have been run through the following summer, have gone to market in the fall as yearlings-past weighing 760.6 pounds. This figure is the average weight for the last three years. Market weights of this kind have given an average gain per head from the calf weight of 311.6 pounds. Such a gain has been possible only because the steers have been kept on fully as good a range as the cows.

In the table, 166 yearling steers are compared with 100 cows, because we know that a pasture which will support 100 cows and their calves will run about 166 yearling steers. In the table, values have been assigned to these gains, eight cents per pound being allowed for the calves and seven cents for the gain in weight in the steers. Of course these vary from year to year so that these

TABLE I

Comparison of Beef Production from Cows and Calves vs. Steer Calves Kept to Yearlings

(1 cow equals 1.66 yearling steers)

Cows and Calves		Steers	
Number of cows	100	Number of steers	166
Number of calves	90	Average selling weight (lbs.)	760.6
Average calf weight (lbs.)	449	Average gain per head (lbs.)	311.6
Gains produced (calves) (lbs.)	40,410	Gain produced (lbs.)	51,725
Value at $8 per cwt.	$3,232.80	Value at $7 per cwt.	$3,620.75

figures can only be approximate. However, the fact remains that the steer yearlings have produced the most pounds of beef from a given pasture.

From a practical standpoint the difference in production is probably not the most important consideration in favor of the yearling steers. The thing in which most ranchmen are interested is the fact that if the steer calves are kept over until they are yearlings, the herd is more flexible and can be more easily adjusted in times of drouth. Every ranchman knows how hard it is, in the spring of the year, when a drouth comes on, to move or sell a bunch of cows with little calves.

In comparison to this, it is fairly easy to move or sell a bunch of yearling steers, thus lightening up in a time when feed is short. Steers can nearly always be sold at less sacrifice than can cows and calves at such times.

During the past few years there has been a growing interest in these plans in New Mexico and a number of ranchmen have proved to their own satisfaction that conservative stocking, together with keeping a part of the herd as steers, is not only attaining greater production, but is making it possible for numbers to be adjusted downward when necessary.

Pregnancy Disease of Sheep

Condensed from The Michigan Farmer

C. L. Cole

Assistant Professor of Animal Husbandry, M. S. C.

PREGNANCY disease of sheep is so named because it occurs only in pregnant ewes and generally within the last 3 or 4 weeks prior to lambing. It is, however, discussed under various other names, the more common being: ketosis, toxemia of pregnancy, acidosis of sheep, lambing paralysis, or ante-partum paralysis. All breeds of sheep are susceptible to the condition, but the older ewes carrying twin lambs seem to be the ones most often affected. The exact cause of the condition is not known, but many of the contributing factors bringing it about have been fairly well established.

Blood analyses of ewes dying from this trouble have indicated a low blood sugar and urine analy-

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ses have shown ketone bodies. Some cases of recoveries have been reported when glucose has been injected into the blood stream and prevention in flocks, when the condition has been prevalent, has been effected when molasses was added to the ration.

The fact that this condition occurs during the latter stages of gestation indicates that it may be brought about by a failure to increase the quality and quantity of the ration in order to provide for the rapidly-increasing demands of the fetus and the preparation for lactation. Consequently, a ration that might be adequate during the first half of gestation would be inadequate to prevent this condition during the last stages of the gestation period. The majority of the cases occur in flocks that are on a rather low plane of nutrition, although this is not always true.

Common opinion has reported that regular exercise may be a factor in prevention. This has not been proved, but neither have many of the other things said of the disorder. It is a condition that has considerable economic importance to the sheepman and general recommendations for its prevention seem to be much more effective than specific recommendations for its cure.

Under ordinary farm conditions sheep that are fed a high-grade legume roughage (one put up without exposure to rains or undue weathering) either with or without silage, seem to be less affected than those fed a badly washed-out type of hay, bean pods, straw, or corn stover as the only source of nutrients. Corn grain, alone, added to low-grade roughages or where the condition is suspected, the addition of one-fourth pound of molasses per day for each ewe, and an increase in the quality and quantity of roughages fed, will probably prevent serious losses.

From experimental data available, it seems obvious that good management practices will go a long way toward the prevention of pregnancy disease in sheep. Maintaining a moderately high plane of nutrition, feeding good-quality roughages, supplying bone meal and salt, watching the water supply, giving the ewes a moderate amount of exercise, and protecting them against undue exposure to adverse weather conditions, are factors that promote constant, good health in the ewes, and seem to be important factors in the control of this condition.

Ground Sprays as Supplementary Control for Apple Scab

Condensed from Farm Research

D. H. Palmiter and J. M. Hamilton

SCAB is the most common and destructive disease of apples in New York State. The disease can be controlled by spraying with lime-sulfur which both prevents and eradicates infection, but the spray may be very injurious to both foliage and fruit. The wettable sulfurs, which are strictly preventive in nature, are preferred because they cause no injury except during periods of high temperatures. These wettable sulfurs have been successfully used in this State in recent years by growers who understand the principles behind scab spraying. They may be ineffective in controlling scab, however, where there is abundant carry-over of infection on the old leaves from the previous year or where the sprays are not properly applied.

Careless growers with severely infested orchards have been observed to fail in controlling the disease with wettable sulfurs thru lack of thoroness or insufficient applications, and all growers in similar circumstances can jeopardize their crop by poor timing. Data are available comparing orchards that are heavily infested with scab with those that are relatively clean under comparable conditions. In 1937 unsprayed trees in two such McIntosh orchards had 100 per cent and 88 per cent scabby fruit, respectively. Trees in these two orchards sprayed with Magnetic-Spray 3-100, a wettable sulfur used at the rate of 3 pounds to 100 gallons, had 55 and 5 per cent scabby fruits, respectively, while others sprayed with the same material 6-100 had 16 and 1 per cent, respectively.

Similar experiences were encountered in McIntosh orchards during 1938.

The obvious answer is that wettable sulfur cannot be used nonchalantly to control scab if there is too much primary inoculum under the trees. Even the more intensive spray program in the heavily infested orchard did not reduce infection to the level of the lightly infested one. It is evident that lower concentrations and fewer sprays may be used if

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the carry-over of scab can be reduced to a minimum.

Such experiences as the above, the non-residue spray program in which sulfur cannot be added to summer oil, the poor fungicidal value of the insoluble coppers and their attendant injury, and the already high cost of fruit production in relation to returns have led to another line of attack in the scab problem. Attempts have been made in the past to rake up the fallen leaves and burn them before growth begins in the spring, but this laborious job did not prove economical or practical. The leaves on the tree may be sprayed after harvest with toxic materials to kill the scab fungus. Experimentally, this has been done in Wisconsin and New York, but it has not been recommended for orchard practice because of certain disadvantages. Toxic materials may be applied in the spring to the old leaves on the ground to kill the spores before they are liberated. This method has shown some promise both in Wisconsin and New York.

During the past three years these ground treatments have been used to supplement spray programs using fewer wettable sulfur applications than normal to determine their value in reducing the primary inoculum and the subsequent improvement in apple scab control. In 1937 and 1938 only nitrogen fertilizers were used. While the treatments prevented a high percentage of spores from being discharged they were not entirely satisfactory due to poor coverage and penetration of the leaves. In 1937 sulfate of ammonia dissolved at the rate of 1 pound per gallon of water sprayed on the old leaves in a McIntosh orchard and five applications of flotation sulfur paste at 6-100 gave the same degree of control as eight applications of flotation sulfur at 8-100 in a similar orchard which received no ground treatment.

In 1938 two neighboring McIntosh orchards which received ground treatments of nitrate fertilizers had about 4 per cent less scab with five applications of flotation sulfur paste at 6-100 than a similar McIntosh orchard which received seven applications of sulfur but no ground treatment.

In 1939 three isolated blocks of McIntosh on the same farm were selected for this type of experimentation. One block was left without any ground treatment and the other two received ground treatments of mono-calcium arsenite 4-100 added to the nitrate of soda and Elgetol ½ per cent, respectively. The Elgetol had shown indication of excellent penetration and killing of the fungus in preliminary tests in 1938. Unsprayed trees in the check block and nitrate-arsenite

and Elgetol treated plots had 72, 3 and 3 per cent scabby fruit, respectively. Trees in the three plots which received only the calyx and 10-day sprays (flotation sulfur paste 6-100) had 43, 3, and 2 per cent scab infection, respectively, while those receiving three sprays had 8, 1, and 0 per cent infection and those receiving four sprays had 2, 1, and 0 per cent scab, respectively. Since 1939 was a dry year, it remains to be seen what such treatments will do in a year more favorable for scab development.

Altho the data presented are limited, they point to possibilities of reducing the danger in orchards with a heavy carry-over of scab to such an extent that it will be possible to use a light schedule of wettable sulfurs with comparative safety. More field data must be obtained before commercial applications of these treatments can be recommended. However, for those growers who feel they would like to try these treatments experimentally, the following suggestions are given:

These treatments will probably not pay for themselves in orchards which were practically free from scab the previous year or on scab-resistant varieties. Growers must not be misled by the fact that they have clean fruit but should examine the foliage, particularly in the tops of the trees, late in the season to make sure scab has not built up on the underside of the leaves with the fall rains. Also, one must not overlook the fact that the spores can blow in from neglected blocks, a point that may not be serious if those blocks are 100 to 300 yards distant or are on the leeward side of the treated orchards. Benefits have resulted only when all the old leaves were thoroly wet with the toxic material, including leaves in fence rows and fields adjacent to the orchard. It is advantageous to go both ways in the orchard. In sod where leaves are collected several layers thick it may be necessary to spray the surface leaves, then loosen the lower leaves by means of a harrow and spray again. An acre may require as much as 500 gallons of solution.

The only effective treatments are made before any spores can be discharged to start infections in the trees. This means the application should be applied just before the green tip stage. These materials have been applied with a power sprayer without difficulty but the nitrogen fertilizers were washed thru a screen to be sure they were dissolved and the Elgetol was added after the tank was filled to avoid excess foaming.

Barbed Wire Cuts Stack

Condensed from the Nebraska Farmer

HALF the time and labor of pitching hay out of the stack can be saved by cutting the haystack in sections with barbed wire. W. P. Kintzley, manager of the Colorado State College farm has worked out a simple method of cutting the haystack. A double strand of barbed wire is sawed back and forth across the stack. Automobiles, trucks, or rubber-tired tractors, or any combination of these may be used to pull the barbed wire back and forth.

"The time it takes to saw up a stack is saved tenfold in the pitching," Kintzley declares. He explains that when the stack is cut in two or three places, hard-packed hay is much easier to get out, and half the usual time of pitching hay onto the wagon is saved.

Two rubber-tired tractors are used to cut stacks on the college farm. A 300-foot length of doubled barbed wire is stretched across the top of the stack and a length of heavy log chain is attached to each end of the wire. A tractor is hitched to each log chain. Between the end of one of the long chains and the tractor to which it is fastened, a heavy spring is coupled to take up the strain of any sudden pull.

When one tractor pulls out the length of the wire, it is thrown out of gear and it coasts as the other tractor pulls it backward. By the time that operation is repeated from 6 to 15 times, the barbed wire, weighted down by the log chain, has cut to the bottom of the stack. The long chains become more important as the barbed wire cuts closer to the bottom of the haystack, for their weight pulls the wire down and makes it "bite" into the hay.

The two strands of barbed wire should be tied with baling wire about every 20 feet to keep them from separating while the apparatus is being moved from one stack to another.

Although the method has been used at the college only on alfalfa haystacks, Kintzley believes it would work just as well on stacks of native hay. He believes, however, that it would not be so great a time and labor saver because native hay strands usually are shorter and do not tangle and mat so solidly as alfalfa hay does.

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Winter Injury

Condensed from New England Homestead

Lawrence Southwick

COLD injury is dependent largely on the minimum temperature reached rather than on the total cold or average minimum over a certain period. Thus it has been shown that one cold night actually caused more damage than many nights with temperatures only slightly higher. Further, the rapidity of the temperature fall is often more significant than the actual minimum reached. Buds of some of our common tree fruits are especially susceptible to injury by a rapid fall in temperature. The same holds true in a general way in regard to other plant parts and especially with roots which are relatively more tender than the portion of a tree above the ground.

The species and variety of plant naturally determine in large part the nature and extent of the damage resulting from any given exposure to cold. But beyond this rather general statement, we can say that the internal condition of the plant at the time of the exposure is of prime importance. Most fruit growers know what is meant by tissue immaturity as it is connected with winter injury. For instance, it is common knowledge that late autumn shoot growth is apt to suffer variable degrees of killing back. This is often seen in the nursery row and in highly vegetative trees where length growth continues up to the moment of freezing. Shoots defoliated in the fall likewise may suffer. Crotch injury, bark cleavage and crown or collar rot may also be attributed not to cold alone but also to that other important contributing factor—tissue immaturity, which according to most authorities refers to a condition brought about by active growth, high moisture content and insufficient storage of photosynthetic products.

Crotch injury between the trunk and the main branch is probably due to delayed cessation of cambial activity. This characteristic is hardly under the control of the orchardist except indirectly. Even though the crotches and crowns do normally continue active growth later in the fall than other tree parts, nevertheless, practices tending to stop and "harden" tree growths will ultimately affect these areas. Often crotch injury is not alarmingly

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serious at any one time, but it easily may be an insidious and sure wrecker of many trees and even entire orchards if not attended to. One way out—a preventive rather that a cure—is to topwork susceptible varieties onto branches of trees of hardy sorts, thus eliminating at the start all tender crucial crotches.

With collar rot also the principles given above apply rather generally. Quite often the writer has seen a mature orchard tree begin to show signs of ill health and declining vigor for no apparent cultural reason. But close examination of the tree trunk at the ground level revealed the answer very definitely. The tree was girdled just as effectively as if done by mice or rabbits. A complete cure of course depends on a good job of timely bridge-grafting. Since discovery is often tardy, serious results accompany extensive damage of this sort.

Cracking and cleavage of living bark from the trunks has been noted in England, Canada, and the United States. Peculiarly, following the winter of 1933-34 bark splitting was more prevalent in Massachusetts than farther north where colder weather prevailed and it affected the hardy McIntosh more than some other sorts. In New Hampshire a severe killing of whole cylinders of bark followed fall nitrogen applications.

Sunscald is a form of injury which fortunately is not widespread since conditions favorable to its initiation occur rather rarely. Here, too, injury is usually a killing of strips of bark on the southwest sides of trees which suggests some connection with the setting sun. One authority points out that rapid temperature fall just after sunset may cause the killing of the tissues. Again it is the rapidity of the drop rather than its actual extent which seems most significant.

Bud-killing is of course a significant type of injury and many orchardists are all too cognizant of its drastic effect on fruit profits. Flower buds are usually more tender than leaf buds and both tend to increase in hardiness as the winter season progresses. In New England the most hardy peach buds rarely withstand temperatures below 15° Fahrenheit. Hence, this is considered a critical temperature. In the early fall and late winter, considerably higher temperatures may ruin the next season's peach crop. The other tree fruits usually have somewhat less tender buds.

Root injury is quite common in fruit trees especially in cultivated orchards where the soil is dry and without a snow or vegetative cover. Different varieties exhibit different degrees of hardiness and it has been found that scion roots

are often less tender than those of the usual seedlings. As a general rule, soil temperatures under approved systems of soil management do not become dangerously low but exceptions do occur and thus injury may be very severe indeed. Roots are relatively tender, being killed at around +16° Fahrenheit. In fall and late winter they may be injured by temperatures as high as +23° F. Under a good snow cover, no such temperatures are approached in this latitude. And it is important to remember that a cover-crop which can catch and hold snow is much more valuable than other types for protecting tree roots from injurious temperatures. Extra protection is also useful in preventing alternate freezing and thawing with resultant soil heaving. Heavy mulching is particularly advantageous and is highly recommended. A fact not well enough realized is that roots uncovered in the fall are subjected to almost certain injury, if any cold weather settles down before snow falls. On the other hand, it has been shown that roots laid bare in early summer attain varying degrees of hardiness approaching that of the branches.

Two further observations need mentioning. First, there is sometimes a definite relation between injury to a tree and the crop production of the previous season. This was brought out clearly as the result of the winter of 1933-34. Trees which had not borne showed much less injury than those which had come through with a heavy crop in 1933. The drain of maturing crops on the tree's resources and subsequent stamina was shown even more strikingly where early picked trees were much less injured by the hard winter than those picked a little later, all other conditions being the same. There were also differences between individual branches on the same tree depending on the crop produced in each case.

As to Pruning

The second observation concerns pruning. During this severe test winter, a general experience throughout New England was that pruning was conducive to increased injuries. It is safe to say that dormant pruning should usually be delayed until the danger of very cold weather is over. Heavy pruning (not recommended today) is apt to be especially disastrous if done in early winter. It is doubtful that much can be gained anyway in heavily pruning the usual orchard trees and especially such trees as those injured by the 1938 hurricane. Pruning has been much overstressed in the past as it has been shown over and over again that all pruning is a dwarfing process and tends to cut down total yields. However, corrective meas-

ures in regard to training, elimination of bad forks, over-crowding and weak wood removal are usually justified, if done at the right time.

This brief picture of winter injury to fruit trees emphasizes the many angles likely to be encountered and it suggests certain methods and means that the orchardist may employ to prevent its occurrence and to alleviate its effects in his plantation.

Intensive Rotational Grazing for Sheep

NEW ZEALAND has long been noted for its efficient and practical utilization of land for profitable sheep production. No other country on the face of the globe produces more mutton, lamb and wool per acre, topography considered, or to greater financial advantage for its farmers. Therefore, a recent report relative to the economics of intensive rotational grazing of sheep by Peren, Hudson, Morton and Yates, of Massey Agricultural College, Palmerston North, N.Z., is of special note and interest.

The adaption to sheep management of the principles of the system of grazing known as Intensive Rotational Grazing is considered by several New Zealand farmers to be practical and profitable even though it involves extra labor and capital. The principles of this system of management are: (1) Subdivision into paddocks of such size that they will carry the number of sheep concerned for 48 or slightly more hours. (2) Shifting the sheep from paddock to paddock in regular rotation. (3) Dispensing with the use of cattle to keep the pastures in order for sheep.

It is claimed that the system has a very beneficial effect on pastures; selective grazing is reduced to a minimum, the pasture is eaten down evenly and close. The golden hoof truly comes into its own under such a system, as the droppings are evenly and uniformly spread over the surface of the soil, and thoroughly trampled in while still fresh. Reports show the system has a beneficial effect on the grasses and plants, perhaps this is because they do not receive continuous cropping and trampling. It is suggested such areas be returned for grazing in about ten days. This system, it is reported, produces a very strong, dense sward and, taken in conjunction with increased efficiency and economy of maximum land area utilization, plus pasture improvement, due to heavier manurial value return, apparently has considerable to recommend its practice.—*Rural New-Yorker*

Engineering Investment on Ohio Farms Exceeds Value of Land

Condensed from The Ohio Farmer

MUCH of agriculture—like much of industry—is engineering; and the agricultural engineer's job is to promote agriculture and to benefit agricultural living by constantly helping the farming public to identify, understand, and improve the engineering with which it works and lives every day.

With the appraised value of the engineering investment on Ohio farms exceeding the appraised value of the farm land itself, there seems good reason that the farming public should become more engineering minded.

It is sad to make a mistake in the kind of fertilizer or seed which we purchase, yet usually such a mistake can be outlived in a year or two. But if we make a mistake in engineering construction or in the purchase of engineering investments, often we must live with that mistake and suffer for it a number of years.

Roughly speaking activities in agricultural engineering can be divided into farm structures, including the economics, arrangement, design and construction of farm service buildings and farm homes; power and machinery, including labor utilization; rural electrification; and water control involving soil conservation, irrigation, drainage, water supply and sanitation.

Shelter is an essential factor in almost every phase of civilization. Land is not worth much for farming purposes without an accompaniment of buildings. Furthermore, present buildings are quite apt to dictate a farming program; or we may wish to change some farming practices but find ourselves badly handicapped by the character, size, or arrangement of the buildings now at hand. A survey of farmers shows that about 30 percent could not change their farming program from a soil depleting to a soil building type because of the present inadequacy of barn space.

Little attention used to be paid to the arrangement of buildings on the farm. Even the exact requirements were not figured. But in these days of close analysis of the efficient use of labor, of conserving time and muscular effort, and of respect for beauty, the entire building program is approached by engineering analysis, and the improvements and

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changes which are made are all in keeping with a well-defined plan. Then actual construction to obtain these features involves good engineering practices reflected thru internal design and arrangement, materials, proper heat, light, and moisture relations, and a number of other factors which must be respected if we are to build as wisely as we should.

Only about one out of every six farm homes has been built since 1909, and a survey shows that the average farm dwelling needs about $1000 worth of essential repairs and improvements not counting modernization. Ninety out of every 100 farms lack modern conveniences such as bathrooms and central heating plants.

Since the dwelling constitutes about 50 percent of the farm building costs it is evident that the average Ohio farm requires about $2000 worth of repairs and improvements to bring the whole investment into a proper state of security and maintenance. In addition to this there should be more modernization from the standpoint of convenience and health facilities.

In a large measure the agricultural engineer has the responsibility for bringing about and maintaining adequate structures for agriculture. Building requirements for home, livestock, crops, and equipment still must be determined. Then it is necessary to select and perhaps even develop new materials and uses of materials.

Obviously the power and machinery phases of Ohio's agriculture involve agricultural engineering in a very extensive way, with a wide range of influences. Fundamentally power is the means of multiplying man's efforts, and machines or implements are the means thru which power is directed toward the accomplishment of various ends.

The advent of power, then, sets up a situation where man can reinvest his time. How he reinvests—or uses time gained—will depend upon his needs and desires. Some express the advantages of power improvements by referring to increased labor return or net profit; some measure the advantages in increased security or maintenance of investment. Greater convenience, improved quality of work, and a lessening of arduous labor are other ways in which some farmers measure the advantage of power improvements. But in a properly managed procedure usually all these advantages are to be had.

One of the great problems in the power machinery area is to establish a balanced program for the farm wherein the relationships between such factors as power available, its form, imple-

ments, labor, and work periods are properly co-ordinated to result in greater efficiency. Thus agricultural engineering starts with a critical analysis of the farm program from the standpoint of the farm's potentialities and the farmer's objectives. This is necessary as a base from which to work, and as an indication of tendencies or imminent changes.

Then an attempt is made to understand the "optimum periods" for certain critical operations or the length of time during which such jobs can be performed when conditions are optimum. Making safe allowances for adverse years, these "optimum periods" are an indication of the amount of power needed for the critical periods, and this may indicate a base for minimum power requirements. Then follows study of the best forms and sizes of power generators in terms of the versatility needed. Adaptability and size of implements now enter the picture; and thru the whole problem the influences of labor and of overhead costs are kept in mind as important factors affecting the efficiency we seek.

This is the same sort of approach which a manufacturer must use in intelligently planning the power, machinery, labor, output, and efficiency balance of a manufacturing plant. Figuring balanced power, machinery and labor programs on farms is not simple procedure; yet it pays good dividends, as some of our successful farmers can testify.

Having too much power and too great an implement overhead may cut into profits as much as being under-powered or under-equipped.

Besides these great over-all considerations of power programs, the agricultural engineer is responsible for the internal technicalities of power and machinery units. Not only is he interested in internal improvements, but also, with other agricultural workers, he must interest himself in the development of new ways and means. Progress in agriculture may depend not so much upon the refinement of present processes as upon the discovery of new ways and means. This subject now is an extremely active area and deserves adequate support for research work.

In the field of rural electrification there is a wealth of evidence of engineering in agriculture, both from the viewpoint of building electric lines to make electric service available to the farmer, and from the standpoint of the actual use of electricity for comfort, convenience, time saving, lower production costs, and better quality products.

Some may think that engineering in rural electrification starts and stops with the erection of power lines to the farm; but this

construction is just a good start. If the program has progressed in orderly fashion farm buildings will be adequately wired and ready for the current by the time the lines are built. That in itself is no small problem.

To get a satisfactory, safe, and economical wiring system considerable planning must be done before working plans are made for the wiring systems. The possible and probable uses of electricity should be considered. Electricity is another form and source of power and it should be assigned those tasks that it can perform best.

That sufficient attention is not given this matter is evidenced by the fact that the average consumption of electricity on farms is still less than 75 kilowatt hours per farm per month. By careful planning and study this consumption may be increased considerably. There are many farms that are using from five to ten times that amount, and doing so to very good advantage. One problem is to find extended uses for electricity.

One kilowatt hour of electrical current will:

Operate 20 50-watt lamp bulbs for one hour.

Heat the electric hand iron from 2½ to 3 hours.

Heat nearly four gallons of water.

Cook one meal for a family of five.

Shell 20 to 30 bushels of corn.

Grind 100 to 1000 bushels of grain.

Milk from 10 to 20 cows.

Do the biggest family washing.

Pump 1500 gallons of water.

Cool 100 pounds of milk.

Shear 75 sheep.

Separate 200 pounds of milk.

Saw a cord of wood.

Grind 250 pounds of sausage.

Grind two tons of feed.

Wash dishes for 10 days.

Elevate 500 bushels of grain.

Mix one-half cubic yard of concrete.

The effects of weather present a serious problem to all farmers. Weather may be too hot, too cold, too dry, too wet. To Mark Twain is attributed the statement: "Everybody talks about the weather, but no one does anything about it." Yet the agricultural engineer can do considerable about the effects of weather upon soil, just as he controls weather to some degree thru farm buildings.

Ohio farmers already have invested about 200 millions in farm drainage systems. There is enough drain tile in Ohio to reach around the world six times—and this is only about half enough. As Ohio farmers install more drainage, will they do so by the hap-hazard guess methods so often used in the past, or will they take advantage of good en-

gineering procedure to make the investment net the greatest dividends?

Drainage contributes to the rapidity with which soils warm up in the spring; hence it tends to overcome some effects of weather that has been cold. It also has an important bearing on the air-water balance of soils.

More than 10 thousands acres of Ohio land are artifically irrigated —another important agricultural engineering problem. Irrigation, besides supplying water, can help in overcoming weather that is too hot. For instance, the potato is a cool weather crop and the evaporation of irrigation water helps cool the soil.

Much of Ohio's most valuable top soil already has been lost by erosion. The streams receiving this soil are being silted-up; their capacity for carrying water is reduced; and the soil remaining in fields has lost some of its water holding capacity. Thus the effects of drouths and floods are intensified.

The agricultural engineer has very definite and important contributions to make in the control of such effects of weather. He designs structures to carry water from rolling land at non-erosive velocities; he designs drainage channels to reduce silting to a minimum; he installs structures to reduce fluctuations in the water table.

The engineer no longer treats drainage, irrigation, and erosion control as separate problems. He recognizes and approaches them in their co-ordinated sense as closely related aspects of the great problem of water control. Included also are the plans and techniques of water supply and sanitation of the farmstead.

Engineering in agriculture is a very broad and vitally important phase of the agricultural business and of agricultural living.

Vitamin D is always required, with lime and phosphorus, for normal bone formation and if deficient, rickets results. Furthermore, this condition may be either prevented or corrected by supplying this vitamin, with proper mineral relations, in adequate amount. Green, leafy, sun-cured legume hay and corn silage are richest in vitamin D of the common farm feeds. Its marked deficiency in the ration may be overcome by giving fish liver oils, some of which, notably sword fish, are much richer in this vitamin than the commonly used cod liver oil.—*Ohio Farmer*

Improving Permanent Pastures

Condensed from The Southern Planter

L. W. Ingham and F. A. Frank

PERMANENT pastures in the past usually have not been given the same care and attention as field crops. It has frequently been assumed that grass would grow under any conditions and usually permanent pastures have been found only on land too rough or too wet to till. It is now becoming more generally recognized that good succulent pastures furnish food nutrients more cheaply, and in a more palatable form for livestock, than any other farm crop. They also seem to have a stimulating effect upon the milk production of cows that cannot be satisfactorily measured by a chemical analysis of the grass produced.

The results on permanent pasture improvements reported herein were obtained with a part of the dairy herd at The National Farm School, Doylestown, Pennsylvania. This work was started because the steady growth of the herd made it necessary to increase the carrying capacity of the permanent pastures. The object of our three years of investigation was to determine the possibility of pasture improvement through an intensive system of pasture management including rotational grazing, clipping, dragging, and the annual application of fertilizer.

The 26-acre experimental pasture was chosen because it had not received manure, lime or commercial fertilizer since the initial application of 250 pounds of 2-12-4 fertilizer per acre in 1929. The 26-acre area of Pennsylvania Sandy Stony Loam was divided at the beginning of the test in the spring of 1936 by an electric fence into four 6½ acre plots, with the following fertilizations:

Plot I received only superphosphate at the rate of 100 pounds of phosphoric acid per acre.

Plot II received superphosphate and muriate of potash at the rate of 100 pounds phosphoric acid and 100 pounds potash per acre.

Plot III received ammo-phosphate plus muriate of potash at the rate of 20 pounds actual nitrogen, 100 pounds phosphoric acid and 100 pounds potash per acre.

Plot IV received Calcium Cyanamid plus ammo-phosphate plus muriate of potash at the rate of 50 pounds of nitrogen, 100 pounds phosphoric acid and 100 pounds potash per acre.

The fertilizers were broadcast-

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ed in early April. This date was chosen in accordance with local practice and was supported by experimental evidence. During the pasture season each plot was closely mowed at least twice after grazing to eliminate weeds and prevent the less palatable grasses from overcrowding the plots. This was followed by dragging with a chain drag to spread the droppings.

Each year the plots were pastured by a group of 40 cows, including approximately ten each of Holsteins, Guernseys, Jerseys and Ayrshires. With approximately 15 per cent of the cows constantly dry their production was generally low, due to advanced lactation. The cows were milked twice daily. At no time was barn feeding entirely discontinued. The amounts of the supplementary feeds consisting of an 18 per cent concentrate mixture; corn silage, and hay later in the season, were regulated in accordance with the milk production per cow. The results of the test were measured both in terms of animal unit days grazing and milk produced. Grass clippings were also made on each plot before grazing started. The results are shown in the following table:

The application of a complete fertilization increased the animal unit days grazing and milk production considerably when compared with a treatment of phosphate or a treatment of potash and phosphate. A total average increase of 27 per cent in animal unit days grazing and 52.36 per cent in milk production certainly justified the annual application of fertilizer. The mounting number of animal unit days grazing shows an increased carrying capacity of the pasture. This result was not only due to enhanced production, but also to the lengthening of the grazing period. During the three years of the tests beginning of the pasturing season was advanced one month. This advancement was chiefly effected by the application of nitrogen as the nitrogen dressed plots were always ready for grazing before those not dressed with nitrogen.

Moreover, though no counts of the plant population were made, a definite improvement in the turf of the plots, especially those

Results of Pasture Test per Acre by Years

Plot No. Plus Fertilization	Animal Unit Days Grazing 1936	1937	1938	Average	Pounds Milk Produced 1936	1937	1938	Average
I P	74	167	158	133	827	2466	2297	1863
II PK.....	145	170	201	172	1760	2532	2963	2418
III NPK ...	247	226	267	247	2968	3560	3950	3493
IV NPK....	243	241	271	251	3019	3725	3769	3504

which received a complete fertilization, could be readily observed after three years of correct management. In spite of the production of a vigorous growth of grass through the use of nitrogenous fertilizers, a suppression of clover could not be ascertained. On the contrary, the percentage of voluntary white clover increased noticeably on Plot IV. Coinciding with the increase of this most desirable of all pasture plants was a remarkable decrease in weeds, effected no doubt to a great extent, by close grazing and mowing. When the Calcium Cyanamid was applied on Plot IV at the time of the first blossoms there was a striking reduction in the number of dandelions. They are one of the worst weeds in the pastures of this section.

These results are of value only if achieved at costs that show a worthwhile profit. The following table gives the milk yield and value of milk, less the cost of production per acre on fertilized plots averaged for the seasons 1936 to 1938.

In the above table the value of the milk produced on the differently fertilized plots is compared with the cost of production. The production costs include the cost of the fertilizer and its application, the supplementary feeds, and pasture management such as clipping and dragging. These figures averaging the actual prices for the three seasons of the experimental period and calculated on the acre basis demonstrate clearly that the complete fertilization not only excelled in the actual number of animal unit days grazing and milk production, but also returned the greatest financial profit. Comparing the results obtained by the application of different amounts of nitrogen per acre, it is evident that the application of 20 pounds of actual nitrogen per acre annually applied in connection with an otherwise complete fertilizer has proved the most profitable.

Results on Acre Basis—Averaged for Seasons 1936-38

Plot No. Fertilization	Lbs. 4% Milk	Value of Milk @ 6c per Qt.	Production Costs	Returns Above Production Costs
I P	1863	$51.98	$20.99	$30.99
II PK	2418	67.44	29.91	37.53
III NPK	3493	97.44	40.14	57.30
IV NPK	3504	97.74	42.63	55.11

There Is No Substitute for Soil Fertility

Condensed from Better Crops With Plant Food

William A. Albrecht

Missouri College of Agriculture, Columbia, Missouri

CROP growth depends on the usuable stock of plant nutrients in the soil, or on that made available during the growing season. Crop rotations represent good soil management because they lessen the rate of plant nutrient depletion from the soil. Legume crops and grass sod covers are considered particularly effective in this respect because of the slower rate of soil nitrogen exhaustion in the former and because of the partial return of the nutrients to the field as animal droppings in the latter. Considered then purely from the crop-combination viewpoint, one can readily reason that any approach toward constant legumes or constant grass cover will approach satisfaction in terms of lessened soil depletion.

The short rotations of the cereals with newer legumes and the lessened soil tillage that have become popular in Missouri are built, in part, on this reasoning. A barley-lespedeza combination is 50 per cent legume, for example. Their satisfaction, however, is not in the crop combination without soil treatment. It must take into consideration the facts, (a) that a soil is being exhausted by any crop order or arrangement under soil management that disregards fertility return; (b) that legumes are ravenous consumers of calcium, magnesium, phosphorus, potassium, and others; (c) that they are nitrogen fixers rather than only soil nitrogen consumers when generously supplied with calcium and the other essential soil bases; and (d) that grass sod or non-leguminous crops, as well as legumes, are becoming less effective for their own preservation, or for forage feed production under increasing soil acidity, or, rather, base deficiency. In our present desire for more sod cover and more legumes, especially those growing on less fertile soils where we are expecting them to demonstrate their soil-saving results, we may well recognize many soils too low in calcium, phosphorus, and other nutrients before these crops can get even a "toe hold" in rejuvenating effects on the land.

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The short rotation combinations of the cereals, barley or wheat with the more popular legumes, such as soybeans, Korean lespedeza, or possibly sweet clover, have been recently adopted for their soil cover value and their pasture extension over the main portion of the calendar. Their provocation of discussion of the subject of rotations has brought with it a recognition of the need for fitting crops to the fertility of the soil as well as into a particular rotation, or crop sequence. Soil fertility depletion has brought us to wheat and barley, in the place of oats, as nurse crops for legumes. This is true because the former two draw much of their needed nutrient supply in their young growth in the fall of the preceding year and lessen competition with the young legume during its first and the cereal harvest year. The oats are the poorer nurse crop, because they "get there first," so far as fertility is concerned, in the same season as the legume. They stay on well into the summer and make it difficult for legumes to succeed in the soil already sapped before they get underway at their delayed and possibly dry season. This shift to nurse crops that get off the land early is acceptance of the evidence of crop competition for a fertility that is getting too low to support both crops at the same time. It commonly places the blame on factors other than the soil, such as the seed or the season. The same declining fertility that has been too low for two crops at the same time has not only been obliterating the legume completely, but has also been lessening the productivity of the cereal, or non-legume, crop itself.

Fertilizers have been recognized as a serious need for the cereals. Superphosphate on wheat has been a safe investment in most parts of Missouri and has extended its effectiveness by establishing the legume nursed by the wheat. Now that drilling fine limestone with the wheat for clover the next spring shows liming beneficial on the wheat in the fall, as well as on the clover the succeeding year, we may remind ourselves that superphosphate of the past contained so much calcium that this element was perhaps doing much of the benefit for which phosphorus was getting the entire credit.

The graminiae, or grass family, on many of our soils respond to the calcium in limestone more than anticipated. Oats reflect the effects of lime additions in their growth, and even corn demonstrates the influence. Limestone serves to mobilize the nutrients into the plant. Fertilizers alone on corn mobilized phosphorus into the crop only one-third as effectively as when used in conjunction with limestone, accord-

ing to chemical studies of the crop.

Parallel with the increase of phosphorus went an increase of calcium in the fodder crop. Barley, used extensively in conjunction with lespedeza, also reflects the beneficial influence of the phosphate and limestone treatments. Its earliness makes it the best of all nurse crops to draw its fertility the preceding season and leave a liberal supply for the lespedeza after the barley harvest. These cereal crops reflect the effects, particularly in composition of their forage, of the lime and phosphates to remind us that, in arranging rotations, the fertility of the soil may be a factor to determine the crop efficiency as well as the crop choice. They tell us that we cannot escape the fertility shortage by offering substitute crops.

Fertilizers for the legume in the rotation tell the same story as for the cereals, only with more emphasis. In our search for legumes which manage to grow on thinner soils, those so found must do so at a lower rate of fertility consumption by giving correspondingly lower yield rates, or smaller offering in the lower concentration of feed nutrients in the forage. Of course, lowered levels in all these are still better than complete crop failure.

Less calcium concentration in the legumes because of its depletion from the soil means less phosphorus mobilized into the plant. It means lowered concentration of protein in the forage, the tonnage yield of which means less protein yield per acre. So when these legumes make tons, it is well to appreciate the need for some test by which we can learn whether they are rich enough in such ash constituents as lime, phosphorus, potassium and others, or whether they are giving protein and items that do more than merely distend the consuming animals' paunch.

Declining soil fertility is reflected in natural vegetation by lowered yields within the same plant kind, or its disappearance and the incidence of such other kinds as can grow by using less nutrients from the soil. Such as make their advent into—and maintain themselves in—the ecological array at the lowest soil fertility level may be expected to be of low concentration in protein and ash. They must then be of low feed value as suggested by their refusal as forage by wild animals. The declining calcium, in particular, in conjunction with a moderately constant potassium level suggests the shift from the proteinaceous to woody plant composition even within the legumes. The same is indicated for the non-legumes to the point where wood production by trees may represent the extreme in cal-

cium reduction in the calcium-potassium ratio. Naturally such also represents the lowest feed value as forage.

In disregarding soil fertility decline, represented by the large calcium depletion to give a narrowed calcium-potassium ratio, we are in danger of accepting forages of lower protein and lower mineral content irrespective of the crop combination into rotation schemes. Crops in short rotations, like any others, respond to soil treatments and are no escape from the facts that soil treatments can be beneficial to them.

Cranberries—$5,000,000 Industry

Condensed from The Agricultural Situation

Howe Bancroft

SEVENTY years ago the production of cranberries was regarded as a "gamble." Now it is a 5-million-dollar industry. Production in 1939 has been estimated at 668,000 barrels. Acreage has increased only about 8 percent during the last 30 years, but production increased about 37 percent during this period, and the farm value of the crop increased approximately 57 percent.

The early Pilgrims found cranberries growing wild in the bogs of Massachusetts, but no effort was made to commercialize production until about 1850. Cultural practices were then developed, varieties were improved, yields per acre were increased. For years, the berries were marketed fresh, largely for the Thanksgiving and Christmas holidays. Canning processes were then developed. Now the berries are marketed fresh or processed, practically the year around.

Acreage has been kept relatively stable during the last 30 years, since the area suitable for the production of cranberries is limited by physical conditions. Production is in 5 states—Massachusetts, Wisconsin, New Jersey, Washington, and Oregon—where the crop is grown on less than 30,000 acres. Massachusetts leads in 1939 production, followed by Wisconsin, New Jersey, Washington, and Oregon.

A Hundred Dead Cities

Condensed from Soil Conservation

Walter C. Lowdermilk

A SOIL conservationist finds in Syria many lessons which we of the United States may well take to heart. There mankind has lived and tilled vanishing lands for thousands of years. Decisive results of wasteful and inconsiderate use of land, as well as of the conservation of soil, may be found in the varied types of country of Syria. One may easily read the land use through the centuries writ large across the landscape, and see the fate of similar areas in the United States, unless a program of full conservation of land and waters is put into effect before it is too late.

Syria holds some of the grandest ruins to be found in the world. The ruins of Baalbek are without compare in grandeur and preservation to any that we have seen; they are some of the most magnificient ruins in the world today. There are huge stone blocks, 30 feet long, 14 feet high, and 14 feet wide, brought from the quarry about a mile away and laid down as foundation stones. Massive monolithic pillars of red granite had been quarried at Aswan, Egypt, and shipped 600 miles down the Nile River, and then across the Mediterranean to the North Syrian coast, unloaded and then rolled by human hands over a 5,000-foot pass across the Lebanon Mountains and down into the Bekaa and to Baalbek.

Hidden at the edge of the mysterious desert of Syria are the almost equally striking ruins of Palmyra, where Queen Zenobia so long defied legions of the Romans. On the North Syrian coast, Byblos, one of the oldest cities in the world, is gradually being brought out of its grave after being buried for centuries in debris. Its fascinating past is now being reconstructed through archaelogical finds.

"Egbert, that young old man," 30,000 years old, has been covered with 40 feet of debris since he lived in a paleolithic cave home. Only last year his skeleton was discovered by Fathers Ewing, S. J., and Doherty, S. J., in the course of excavations of a paleolithic site near Beyrouth.

To a soil conservationist, the most striking ruins are those of about a hundred or more Dead

Reprinted from Soil Conservation, Washington, D. C., Dec., 1939

Cities in North Syria, where soil erosion has done its worst and spread a ghastly destruction over a landscape of 1,150,000 acres of formerly productive lands.

These Dead Cities in their almost prefect state of preservation seem to have been more asleep than dead for 13 centuries. They have not been buried by erosion, but stand high on their rock foundations on the limestone hills, from which 3 to 6 feet of productive *terra rosa* soil have been washed away. This soil was the basis of a remarkable prosperity and opulence in ancient times.

Seldom does one find remnants of the red earth which formerly clothed the limestone hills; it is lodged in the narrow valley floors where it was saved from being swept out to the Orontes River by winter storms. The good earth is completely gone from the slopes except where walls of ruined buildings have held back small patches of soil. In these patches a few vines or olive trees stand as sorry remnants of a former profitable land use. Otherwise, the landscape is gray desolation, glaring in the summer heat and bleak in the winter cold.

These ruins are found in a region that is almost a desert today, lying within an area outlined by four great ancient cities, namely, Antioch on the west, Apamu (Kalaat el-Moudik) on the south, Chalcis (Quuniesrin) on the east, and Berea (Aleppo) on the northeast. Traced out on the map this region is a long rectangle about 20 miles wide and 90 miles long, or about 1,800 square miles, a huge area where erosion has done its worst.

The Dead Cities of North Syria reveal a period of history of which very little is thus far known. It was a local civilization but very advanced and rich, with a highly developed and distinctive Syrian art found nowhere else. This art was surprisingly delicate, full of freshness and originality. Father Mattern outlines the steps wherein one may follow a constant rise from the third to the seventh century without sign of decadence. But it was cut off in its vigor of life and development by the invasion of the Persians in 614 and the conquest of the Arabs in A. D. 630. These nomad invaders killed the inhabitants, blotted out their art and culture, and destroyed their cities, their vineyards and their olive orchards, and the traditions of their agriculture. Today, after thirteen centuries of neglect and patch cultivation to cereals by seminomadic descendants of the invaders, and of overgrazing by their goats, soil erosion has completed the destruction of the good earth with a thoroughness that has left this once fertile land a complete man-made desert, void

of vegetation, water, and soil, except in rare pockets with scanty cover of crops and thorn bushes. The ruins of a highly developed architecture tell of the advanced culture of this region.

The first revelation of these Dead Cities of North Syria, after an undisturbed sleep of more than a thousand years, was made in 1861 by Viscount Melchoir de Vogue, who published his findings of his field studies in two volumes. Another survey, made with Dr. Alford Carlton, President of the Aleppo American College, appears to be the first to study the lost agriculture surrounding the ruins.

This region was once covered with extensive forests. Present day remnants indicate that the principal species were of oak, pine, cypress, and cedar in the higher elevations. Evidence of the forest is found in the architecture. Had not an abundant supply of timber been available the architects would have developed a different type of construction, as they did in the Hauran and elsewhere where timber was not readily accessible. These villas and grand rooms and churches required sturdy timbers of wood as called for by notches in the walls at El Gami, Bara, and other ruins. The ceilings were generally of wood. Much timber was also required for the galleries and furniture and fuel for heating the villas and the water for the baths. Large timbers must have been needed to raise the enormous blocks of stone used in construction, and to build the forms on which were laid the heavy stone arches. Thus for four centuries at least there must have been a sufficient supply of timber in the near vicinity, and of an amount to arouse no anxiety for the future. The removal of the forest doubtless took place as a slow deforestation of the mountains and cultivation of cleared areas, and later the planting of vineyards and olive orchards on a vast scale.

Father Mattern holds that this area was definitely an intensive agricultural country. The location of the houses indicates that the inhabitants did not possess great territorial properties as did the Romans in Campania, Italy, Sicily, and North Africa. These Dead Cities, even in the more isolated regions were much too close together to allow for anything but intensive exploitation. Furthermore, the wealth could not have come from great herds, for the population required that the use of land be much more intensive than pasturage. These populous cities were doubtless supplied from the products of the immediate countrysides because there are no fertile areas in nearby plains accessible by roads to supply them with produce. They

were self-sustaining and derived their wealth from exports of agricultural products.

Many olive oil and wine presses are to be found in the ruins, especially at Bara. There is what was obviously a large olive oil factory, with ruins of numerous presses and great bins. Mattern reports countless presses in his detailed examination of a large number of ruins. These presses are found everywhere on the ground floors of villas or in the neighboring houses in towns or in the cities. They were sometimes cut in the rock and most often accompanied by reservoir cisterns. Often one finds them grouped, indicating that harvesting of a considerable area was carried out in common.

The olive and the vine doubtless provided the wealth and prosperity of the country. Wine and oil were two products which could easily be exported at good prices to Italy and the great cities of the west. The hill of Testaccio on the borders of the Tiber in Italy is entirely formed by the debris of the huge earthen jars of wine and oil which came by boat from the area of these Dead Cities, and were here transferred to smaller jars for sale. The great jars, characteristic of North Syria, were too numerous for further use in Italy. It does not seem that their return was considered feasible. And so important was the import of wine and oil that the broken jars when cast out during centuries of time had built up the unique hill of Testaccio. This remarkable hill gives some clue to the great production of this area in exportable wines and oil. The producers were enriched and the auxiliary industries shared in the prosperity of the land.

This region, before erosion transformed it into a desert, was well supplied with water. One finds stone spring houses beside springs which ceased to exist when the soil was removed by erosion. In some instances there appears to have been perennial water in the now dry streambeds. Moreover, these people were supplied with numerous and large cisterns, both in fields and towns. Each home was supplied with one or two cisterns within the walls to provide water supply during the rainless summer season. Many cisterns can be noted along paths and among the ruins. They are excavated out of the rock in the form of immense jars to protect them from caving in. The quarried stone was then used in the construction of buildings.

The evidence is that soil erosion was sufficient to destroy this area which supported a hundred or more prosperous cities of North Syria until 12 centuries ago. In a number of instances measurements have been made of the depth of soil which has been

removed. For example, at the church of Mousabbak, the first steps begin at 4½ feet above the present ground or rock level. These lower blocks are foundation and undressed stones whereas 4½ feet higher the steps and stone work are dressed and polished. These foundation stones were formerly covered and have become bared since the ancient soil was washed away. Also, it is impossible to explain the use of certain olive oil presses except on the assumption that the soil was then 6½ feet deep over the present rock surface. This depth of soil must have been washed away. Soil wash in still continuing where any soil is left. Butler, of the Princeton Expedition, reports having observed the process during a winter storm. In some places caps of red soil still remain on the tops of mountains as at Djebel Sheikh Berekat or on level areas, and from these flow red streams of soil during the rainy season, giving a last example of what has gone on for centuries in North Syria.

It is not necessary to invoke adverse climatic changes to explain this desolation and desiccation of this ancient prosperous region. Wherever the walls of ruins prevented the soil from being washed away, vines, olive trees and shrubs are growing today. Bara is still noted for its vines, which are limited now to the few places where patches of soil are still found. Two miles south of Sunkhar a grove of trees appears as an oasis in a dreary gray land surrounding a high tower among the ruins, where a large pocket of soil has been held back on a flat protected by walls. The town is in ruins and the lofty tower rises in splendid isolation above the trees which occupy the only remaining soil in this region.

As in North China, North Africa, Trans-Jordan and elsewhere, soil erosion is clearly the principal agent in destroying the land and in undermining the civilization and culture which was dependent upon it. The early inhabitants found primeval forests here. Then began moderate clearing, deforestation and cultivation of slopes. Ancient cultivation up through the Roman period was intelligent, and demonstrated an understanding on the part of the inhabitants of the conservation of soils and rain waters by terraces and check dams. At this time the region was highly prosperous, populous, and flourishing. But in A. D. 630 the Arab invasion swept away progress in agriculture. The vineyards and olive trees were destroyed, and the land was put under patch cultivation to grain crops and heavily grazed. After the destruction and dispersal of the former population, neglect of the land, especially under the Turkish dom-

ination of 400 years, brought on erosion of the soil. The hordes of invaders from the east and south, in their rapid passage, had neither the time nor the means to demolish the huge stone blocks comprising the great buildings. But by fire and the ax they destroyed the remaining forests as well as the plantations of olives and vines.

These nomad invaders have always shown themselves to be enemies of trees; their descendants have remained true to this hate, whether it be in North Africa, Syria or Trans-Jordan. The Arab nomads are spoken of as "sons of the desert," but in view of the deserts they and their goats have created, it would be more fitting to speak of them as "fathers of the desert." They pitch their black, batlike tents amidst ruins of the magnificence of the past and allow the terraces to break down and the soils to wash away. They permit their goats to destroy and trample out the former measures for conservation of soil and water. They practice a Neolithic type of agriculture; for they are always on the move and have little interest or inclination to protect the diminishing soils. The nomad invaders and their goats worked hand in hand with erosion to destroy the fertility of the lands.

These hundred or more Dead Cities are dead forever because their soils are gone beyond any hope of reclamation. The cities could be made habitable again with no great amount of work. The buildings would be more sumptuous than those in any of the Twentieth century towns and villages in this or surrounding areas. But when this good earth was sinned against it would not produce; it carries the curse of despoliation which continues to curse this region. Man and erosion have devastated this area for a geologic age. Here the "unpardonable sin" of land use has been committed.

Man-induced erosion of the soil has in this region of about 1,150,000 acres done its worst; it has swept 3 to 6 feet of soil from the hill lands, baring the limestone skeleton of the country. It has removed the support of the former prosperous population which found wealth and leisure enough to delight in and develop an art and architecture of unusual vigor and beauty. The people and the civilization vanished, leaving the Dead Cities of North Syria as tombstones above a stark and barren landscape. They tell the tragic story of the terrible curse upon the land and future inhabitants when soil erosion is permitted to despoil the soil and water resources.

How Smart is a Dog?

Condensed from Southern Agriculturist

S. R. Winters

THE U. S. Department of Agriculture at the National Agricultural Research Center near Beltsville, Maryland, is now engaged in a new project: Analysis of the inheritance of intelligence and temperament in farm animals. Dr. W. M. Dawson, who is in immediate charge of this study, says that the first work is being done with dogs, in order to keep expenses low; and because dogs probably have a wider range of intelligence than other farm animals. As compared with horses and cattle, dogs cost less per animal, require less room, eat less feed, breed more rapidly, mature more quickly, and are naturally more co-operative in being handled under laboratory conditions.

Mr. Dawson and his associates have found it necessary to evolve and apply definite intelligence tests, in order to determine what progress is being made in breeding and in training for intelligence. When breeding for size, color, conformation, or any other physical quality, the problem of measuring the character is often relatively simple; but intelligence in animals, and especially progress in intelligence, is difficult to measure.

Several breeds of dogs are now used in this breeding, training and testing work. They include the Hungarian Puli, German Shepherd, Chow and Border Collie. Attempts are being made to cross these breeds in such a way as to produce cross-bred animals of greater intelligence than the foundation stock.

The work at the Beltsville farm is only at its beginning, but already Dr. Dawson and his assistants have worked out four definite intelligence and temperament tests that are being applied to the 64 dogs under their care. These tests may be enumerated as follows: 1, whistled signals; 2, herding sheep; 3, reaction to strangers; 4, finding their way out of cages. In test No. 1 the dog, at a given signal, lies down and remains there awaiting the signal to stand up. When that is given, he obeys promptly. While herding sheep, in test No. 2, the dog obeys whistled signals and other signal calls; and he herds the sheep when directed from a distance. In test No. 3, the dog's reaction to a stranger is observed.

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This is really more of a test of temperament than of intelligence. It is hoped, however, that in addition to giving information on the temperament of the animals it will serve as a check on the results obtained in other tests. In test No. 4, the dog must find his way out of a cage-like apparatus having four doors, only one of which is unlocked. If the same door were always left open, the intelligent dog would learn, after a few trials, to push that door only, so the problem is made harder by locking the door that was formerly unlocked, and leaving another door unlocked. The bright dogs learn to try each door until finally they find the right one, while the more stupid dogs dogs do not try all the doors, but repeatedly attempt to escape through the same door. Sometimes it takes them several minutes to get out. In each case when the dog has solved the problem and worked his way out of the box, he finds a piece of meat as a reward.

Dr. Dawson says that various prizes are used to induce dogs to do their best. The prize some dogs prefer above all others is the approval of their master and the punishment they most dread is his disapproval, while others care little for the trainer's attention, one way or the other.

The 64 dogs on the Beltsville farm might be said to be still in the primary grades of Dr. Dawson's dog training school, and the lessons are few and easy. But from what we saw on our visit to the school we are looking forward with enthusiasm to a later visit, when some of the most intelligent dogs will have reached high school or college.

Producing a Two-Pound Broiler

Condensed from New England Poultryman

D. H. Horton

Head of Dept. of Poultry Husbandry, Institute of Farmingdale, New York

THE number of weeks required to produce a two pound broiler will depend on the breed of chicken, the kind of feed used, whether both sexes or only cockerels are sold, and general management. As strain or families of chickens vary in regard to size, this is also a factor to be considered.

When all the conditions, which go to make for successful brooding are decidedly favorable, gains in weight considerably above the

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average are made. However, the experienced poultry raiser knows that many times some condition arises which serves to hold back the rate of growth of his chicks and when marketing time comes, his birds are only average or below average in quality. Market reports continually indicate that a majority of the live poultry received in wholesale market is not the highest or "fancy" quality.

One of the tools of high pressure salesmanship is the exaggerated claims made for certain products in connection with broiler raising. The exception to the rule is made to appear the general average which one might expect. It is implied that what is actually the weight of a selected part of a flock is the average of the entire group.

Those who have had little experience in broiler raising and poultrymen who may be planning a budget for the new year will do well to consider average weights compiled from several State Agricultural Experiment Stations. The following are average figures from Missouri on R. I. Reds and Cornell on Reds, Rocks and Wyandottes:

Missouri and Canada on White Rocks and Barred Rocks:

Cornell, Missouri and Canada on White Leghorns:

Good practice requires that one aim to do better than the average, but in making plans it would seem wise to consider average figures.

Age in Weeks	Ave. Wt. (Pounds) Both Sexes	Ave. Wt. (Pounds) Cockerels Only
8	1.38	1.59
10	1.84	2.08
12	2.24	2.47
16	3.27	3.96
8	1.13	1.32
10	1.60	1.74
12	2.18	2.43
16	3.29	3.72
8	1.15	1.26
10	1.50	1.69
12	1.92	2.14
16	2.61	3.06

The browning of evergreens, particularly arbor-vitae, in the fall and early winter is a natural process and is nature's way of shedding or pruning the older leaves and branches, says Dr. F. L. Gambrell. Excessive browning at other seasons of the year, however, may be a symptom that should receive the attention of the gardener.—*Farm Research*

Plant Food Developments

Condensed from The Fertilizer Review

Dr. H. H. Zimmerley

Director, Virginia Truck Experiment Station, Norfolk, Va.

IT is possible that agricultural historians in the future may refer to the period through which we have been passing during the past decade or two as a great transitional period in American agriculture. The marked changes in agriculture brought about by the widespread motorization of cultural and transportational equipment and by world-wide economic developments have stimulated experimentation in the fields of economics and biology. There is no doubt that the recent economic condition of agriculture has greatly stimulated research by Federal and State institutions along those lines which tend to lower unit production costs or to improve the quality of farm products. Progress has been greatly accelerated by marked improvements in research equipment, by increases in Federal and State appropriations and by, what is far more important, the services of a host of young men well trained in our graduate institutions to solve the vitally fundamental problems in biological research. So rapid have been the strides made in the field of plant nutrition that farmers, research workers, and those engaged in the manufacture and sale of fertilizers are puzzled when they try to grasp the full significance of these new developments and apply them in agricultural practice.

From the standpoint of definite achievement over a wide territory and with a great variety of crops the subject of fertilizer placement heads the list. The work of the Joint Committee on Fertilizer Application and its co-operators should serve as a classical example of what may be accomplished by a large group of coordinated workers. At the very beginning the problem was fairly well defined. Growers, fertilizer manufacturers, and research workers realized that much valuable plant food was being haphazardly applied. This resulted in a tremendous waste of fertilizer, seed, and human energy.

A research program, started in a modest way in 1929 with 4 experiments with 2 crops in 3 states, soon expanded along a wide front and is now a major line of nation-

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wide investigation. By 1938 the volume of experimental work had expanded to include 146 experiments at 70 locations in 27 States, with 29 different crops. It was realized at the beginning that an extensive project of this kind could not be carried on unless each group performed its assigned task wholeheartedly.

The work of designing and manufacturing experimental equipment, without which the work could not even have started, was admirably carried on by the combined efforts of the workers in the Bureau of Agricultural Engineering of the U. S. Department of Agriculture and a group of farm equipment manufacturers. The National Fertilizer Association performed the important task of keeping the machinery well oiled and running efficiently and in assembling, publishing, and distributing the reports. Members of the American Society of Agricultural Engineers, American Society of Agronomy, American Society of Horticultural Science, Farm Equipment Institute, and The National Fertilizer Association served on various subcommittees in charge of special phases of work. And last but not least comes the host of cooperators in the various experiment stations, who carried on the work in the field experiments in their respective States.

One outstanding accomplishment is the fact that an analysis of the great mass of data accumulated over a ten-year period points to some very definite conclusions applicable to a great variety of crops grown on markedly different soil types under a wide variation of climatic conditions. These may be briefly summarized as follows:

Fertilizers when applied simultaneously with the planting of the seed should be placed in narrow bands either on one side or both sides of the seed row and in most instances slightly below the level of the seed to prevent fertilizer injury to seeds and seedling plants. The optimum distances of location of the bands both laterally and horizontally with respect to the seed in the row have been determined for most of the major crops on many of the more important soil types.

Band placement has given consistently higher yields than have other types of placement during dry periods when the application of fertilizer in contact with the seed, too near the seed, or directly under the seed has resulted in marked injury to either the seed or to the seedling plants. Even during periods of favorable soil moisture conditions it has proved equal and in most cases superior to other types of placement.

Side placement in narrow bands permits the safe use of large amounts of fertilizer at the

time of planting and gives maximum response from small quantities by providing a relatively high concentration of nutrients near, but not too close to the roots of the young plants. It results in a marked increase in efficiency of the phosphorus by placing it when it is available to the plant through its entire period of growth and by retarding the rate of phosphorus fixation. This frequently results in earlier maturity and a product of superior quality.

It permits the use of a better nutrient balance in the fertilizer. Snap beans, lima beans, and other crops, especially sensitive to fertilizer toxicity, have failed to show response to potash even on soils showing a very low available content unless fertilizer containing potash was applied in bands at a safe distance from the seed. This phase opens up an entirely new field of research. It shows that the results of many of our former fertilizer experiments where we now know that fertilizer was improperly applied, should be repeated, using the band method of application, to tell us the whole story regarding response to different N P K ratios.

The results of placement studies with transplanted crops indicate chiefly that side placement in bands is good insurance against a poor stand of plants, especially under unfavorable weather conditions. However, in the case of tobacco and sweet potatoes, band placement has generally resulted in marked increase in yield, even where the effect on stand was not a factor.

After a period of ten years a great mass of data has been collected, the interpretation of which would greatly cloud the picture were it not for the summaries of achievements and recommendations prepared at intervals by the chairmen of the groups responsible for the various crops. The latest summary was published by The National Fertilizer Association in April, 1938, under the title, "Methods of Applying Fertilizer." The following are a few of the summations made regarding the economic value of band placement for some of the major crops in the South.

Average yields of cotton in experiments in the Southeastern States, in which fertilizer was placed in bands on each side of the row, were 104 pounds an acre more than where fertilizers were mixed with the soil under the seed in a zone about 3½ inches wide. With favorable soil mixture conditions, results of various placements did not differ widely, but side placement generally gave better results under all conditions. This procedure is worthy of adoption for the sake of insuring a good stand which should result in larger yields.

With the tobacco crop the average results for a period of 2 to 4 years in a total of 12 experiments indicate an actual average value of $306 per acre where fertilizer was applied in bands 2½ inches to the side and 1 inch below the root crown, as compared with $284 an acre where application was made by the local method, which was drilling in the row by hand and mixing with the soil before ridging. This increase of $22 per acre more than paid the fertilizer bill.

Results with potatoes in six States over a four or five-year period showed that side placement resulted in higher yield in 23 of the 27 tests. In Virginia, the only Southern State included, side placement 2 inches to each side and at the seed piece level gave an average increase of 20 bushels per acre over a period of 4 years. Placement demonstrations in North Carolina at 6 locations in 4 different counties in 1937 showed an average increase of 15.2 barrels per acre for the side band placement, when compared with the local methods of applying the fertilizer in the row. Proper placement is exceedingly important with sweet potatoes. Since application in the row prior to setting the plants has been found exceedingly hazardous, most successful growers delay application until a week or two after plants have been set.

In Virginia in 1938 the application of 1,000 lbs. of fertilizer in bands 4.5 inches to each side and 3 inches below the surface by machine at transplanting produced an average yield of 43 bushels more per acre than did similar amounts applied in delayed applications made according to a previously recommended practice. Experiments in the South have shown that peas and beans are very sensitive to injury by the large amounts of fertilizer used in that area. Direct contact in most cases ruined the stand in dry seasons and resulted either in low yields or in total losses. Side placement in bands proved safe in all cases and often increased yields as much as 40 bushels per acre over those obtained by the methods of application generally used by the more successful growers.

There is still a divided school of thought in regard to the question of sources of nitrogen, particularly with respect to the relative value of the so-called "natural" organics, as compared with other forms. Undoubtedly, in many instances the deleterious effects obtained in the earlier fertilizer experiments by the continuous use of certain mineral fertilizers over a long period were due largely to the acidifying effects, ultimately resulting in magnesium deficiency and aluminum toxicity. Difficulties arising from

this source are now rapidly being eliminated by the widespread use of neutral fertilizers.

Mehring estimates that the quantity of liming materials used in making mixed fertilizer increased from 98,654 tons in 1933 to 302,751 tons in 1936 and the net equivalent acidity of an average ton of mixed fertilizer dropped from 152 pounds to 19 pounds during that period. This rapid increase in popularity of neutral fertilizers is encouraging, since it is an important step toward the prevention of further acidification of our soils and has already largely eliminated injury from magnesium deficiency in crops along the Middle Atlantic Coast. The only instance, to my knowledge, where acid forming mixtures are preferable is where potato soils are not sufficiently acid to keep scab under control. It is now generally conceded by agronomists that the water insoluble organic forms of nitrogen are not superior to the water soluble forms for cotton, corn and other grain crops, or for truck crops where the total amount of nitrogen applied in the mixed fertilizer does not exceed 30 to 40 pounds per acre. However, the agronomists composing the Tobacco Fertilizer Committee for the States of Virginia, North Carolina, South Carolina, and Georgia still recommend that one-third of the nitrogen be derived from organic sources for maintenance of high quality in tobacco.

The chief point of disagreement lies in the recommendations with respect to sources of nitrogen in potato and truck fertilizers where as much as 120 pounds of nitrogen are commonly applied per acre in a mixed fertilizer. Growers in eastern Virginia, and possibly in other potato growing regions of the South, would be hesitant in accepting recommendations for eliminating all water insoluble nitrogen from potato fertilizers unless they could be furnished convincing experimental evidence obtained on a wide variety of soils over a period of three or more years. Results obtained in North Carolina and South Carolina indicate that the importance of water insoluble nitrogen in potato fertilizer has been overemphasized. A comprehensive study along this line will be started in the near future in Virginia.

In this connecton it may be well to mention the potash situation, particularly with respect to relative value of muriate and sulphate of potash. According to information received from a very reliable source, there is no basis for belief that there will be a shortage of potash for use in agriculture and the chemical industries during the next year. American companies, by running to capacity, can produce more pot-

ash annually, without increase in refinery capacity, than was used in this country last year. Should there be a slight shortage of sulphate of potash next year, it can be handled by substituting muriate of sulphate where the latter is not practically needed, so that there will be sufficient sulphate for the tobacco and possibly a few other crops.

It has been suggested that the fertilizer trade request growers to permit substitutions of muriate for sulphate wherever experimental evidence has shown this to be a safe procedure, in order to prevent any possible shortage of the sulphate form for crops which really need it.

Getting Trees off to a Good Start

Condensed from The Rural New-Yorker

H. B. Tukey

THE establishment of a newly planted tree in intimate contact with the soil moisture may be brought about in many ways, but in any event its importance cannot be over-emphasized. The Stringfellow method of planting and the "ramming" method seem to have been successful mainly because they placed the roots in intimate contact with the soil; yet the puddling of the soil occurred under such conditions and to such a small amount of soil that the new roots quickly developed beyond the unfavorable environment. Too often an air pocket is left immediately under the roots. Tramping the tree firmly in place is widely practiced and generally successful. Recently, granulated peat moss has been used successfully mixed with the soil in the tree hole planting. One of the advantages has been in the ease with which a tree is firmed into place, the peat-soil mixture resulting in a springy, tight condition. Since wet peat is used, there is the additional advantage of placing moisture directly against the roots throughout the adjacent soil.

The old methods of pouring a pail of water over the soil when the tree is planted is helpful because it causes the soil particles to flow compactly together and around the roots, besides supplying water in immediate contact with the roots. No better method of compacting soil is known than washing it with water, and it is used by engineers in the building of dams or in other places where

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thorough compacting of the soil is essential.

European planters still cling to the old method of dipping the roots in a heavy mud mixture before planting. Experiments seem to indicate that the advantage from such a treatment, if any, is not in the protection of fine roots from drying out, as has often been thought. These fine roots are not involved in regeneration of new roots to any considerable degree. The advantage lies, rather, in placing material with a larger surface area into intimate contact with the roots forming a connecting link between the roots and the soil particles. Good results in propagating cuttings, for example, have been secured by dipping the cuttings in finely divided chalk or clay.

A discussion of the encouragement of root formation properly introduces the topic of fall versus spring planting. Planting in early or mid-fall when soil temperatures are in the neighborhood of 40 to 50 degrees is favorable to root development. Much rooting may occur in late October, November, and even early December in open seasons. In the rooting of apple and quince layers it has been observed repeatedly that root formation may be only moderate up until September, and that thereafter and prior to the freezing of the ground, root development is exceedingly active. On the other hand, if planting is done so late that roots have no opportunity to develop before the ground freezes, the tree may not become established and may heave during the winter and be subject to winter injury and drying out as well as to blowing and misplacement.

Again, a low oxygen level is unfavorable to root development, and if the fall is excessively wet, root formation may be retarded because of poor aeration; and, for that matter, excessive moisture in spring may also be detrimental and for the same reason. Horticultural writers have emphasized this point for at least a generation. Patrick Barry, writing in "The Fruit Garden" in 1851, says: "In parts of the country where the winter is long and severe or where freezing and thawing are frequent, fall planting cannot be successful, as the plants, having no hold of the ground, are drawn out and injured; and beside, if the ground is somewhat clayey and tenacious, the heavy rains that occur early in the spring will make it so compact that air will not penetrate it, and the young roots will form slowly and feebly. When neither of these difficulties is to be feared, fall planting is decidedly preferable. Spring planting should be done at the earliest moment the condition of the ground will admit, which is, when dry enough to crumble into

fine particles when turned over with the spade."

The use of granulated peat moss in planting has been helpful in this respect, too, since it has increased the porosity of the soil mixture and has provided better aeration. Of two lots of trees, one planted in soil with excessive moisture content and one in a peat-soil mixture with excessive moisture content, the latter made strikingly superior root development as well, amounting to 109 percent gain within 92 days after planting. The comparison of atmosphere, water and soil, is as follows, showing the greatly increased porosity and aeration of the soil where peat moss was incorporated in the soil.

	Atmosphere	Water	Mineral Soil
Soil (wet)	8.1%	37.4%	54.5%
Peat-soil (wet) ..	39.1%	34.9%	26.0%

Another useful practice in planting is the digging of the hole in the fall, leaving it open to the freezing action of winter. Then, since the soil thrown out from the hole drains rapidly it is in a condition much earlier in spring to throw back into the hole when the tree is planted, than otherwise might be the case. Not only is better aeration afforded by this method, but the soil is in generally better physical condition due to the freezing action of the winter and the lessened likelihood of puddling the soil when the hole is dug or the hole filled in the planting operation. Further, earlier planting is possible, at a time when the low soil temperatures prevail which favor root formation. Broken or injured roots should be cut back with sharp cuts, since the new roots form from these larger roots. The loss of a few small fibrous roots seems to be of no great importance; it is the main roots which must be favored.

The factors which favor deep penetration and spread of roots are similar to those which favor root formation, but the topic is mentioned separately because of its importance. For, if a method were used which would favor the formation of roots in a restricted area and prevent spread of the root system into the adjacent soil mass there might be high mortality during subsequent growing months. It is this condition which prevails when a dry summer follows an excessively wet spring; root spread is restricted, top development is large, and when the soil moisture decreases the roots are unable to supply the needed moisture to the top. Accordingly, if the use of granulated peat moss resulted in the development of roots solely in the area containing peat moss, it might, in some seasons, be a poor material to use. Examination of roots of trees so planted, however, has shown

a much greater extension into the adjacent soil mass than of trees planted in soil alone, explainable, perhaps, on the basis of improved aeration of the soil mass by virtue of the "chimney" of peat-soil mixture extending from the surface of the soil downward to the roots. Needless to say, planting on marginal land with poor drainage, particularly such plants as the cherry, should be avoided since root development is poor under such conditions and tree mortality is high.

Vigorous shoot and foliage development is dependent upon adequate moisture during the growing season, based in turn upon a well developed root system and adequate soil moisture. Here again, peat moss incorporated in the soil has been helpful in that it has maintained a "chimney" of loose peat-soil mixture close to each tree to catch the surface water and permit easy penetration. Fertilizers have been used in the tree hole at planting and in close proximity to the roots the first year with disastrous results. Generally speaking, the tree should and does have within it the necessary food materials for the initiation of growth. Fertilizers may burn the roots or injure them so as to restrict development while, at the same time, possibly encourage excessive top development, thus bringing about injury or death to the tree in case the moisture supply in the soil is reduced later in the season.

It seems unnecessary to mention the fact that protection from insect and fungous attack is also important, yet there have been cases of neglect, with resultant partial or complete defoliation and winter injury the following winter from a weakened condition. The top must be reduced to balance the reduced root system incident to transplanting. If the trees are merely transplanted from one field to another adjacent, the cutting back need be little or none. Trees have been transplanted in this way by the writer, with no cutting back, and have done well. But, in most cases there must be some removal of branches. Here again, the fewer, the better. Thinning out of branches where feasible, is better than heading back. Unfortunately, the amount of cutting is dependent largely upon the shape of the tree when it is received from the nursery, and all too often the lateral branches are impossible to retain for scaffold branches and the tree must be severely cut back, even perhaps, to a whip. Nevertheless, the least cutting that can be done, and still keep a balance between roots and top and still develop a good scaffold system of branches, the better.

Brahman Cattle in South Texas

Condensed from Texas Farming and Citriculture

James W. Sartwelle

American Brahman Breeders' Association

THE cattle of India, otherwise known as Bos Indicus, are sometimes called Zebus and are the oldest breed of cattle in the world. It has been said on good authority that the origin of more than one-half of the cattle in all the world is traced to Bos Indicus.

India has for thousands of years been a very densely populated country and its livestock, particularly cattle, were woven into the warp and woof of the national economy. Maintenance of the cattle population was so necessary as to give rise to the theory that these cattle were the gift of the Gods and were therefore sacred. It may be interesting to dwell for a moment on just how dependent the people of India were upon their cattle. Most of the transporting and heavy hauling was and is done by cattle. They plow the fields, pump water for irrigation and furnish the motive power for grinding grain and pressing oil. They, of course, furnish the milk, butter, curds, cheeses and meats. Last but not least, the hides are tanned into leather for wearing apparel, shoes, tents and many other articles. When the Duke of Wellington had finally conquered India and forced the capitulation of the Indian armies under Prince Tipu and the Prince was in the headquarters of the Duke negotiating the terms of surrender, the Englishman remarked that Prince Tipu had moved his armies, together with all their stores and ordinance, faster and further than on any marches in known history. He asked Tipu how he had done it. The Indian General did not reply but asked the Britisher to accompany him to his camp, where, under the brow of the hill, he pointed out a great herd of Indian oxen. The Duke of Wellington was so impressed that in his official report he recommended that the British Government give particular attention to preserving these fine Indian cattle. This was done, and for many years the cattle of India were looked after by the British Army.

Again referring to Indian history and continuing the thought of the great importance to the life

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of the nation of its cattle, the priests of India ruled that any of their devotees desiring to propitiate the God Brahman could do so by giving him a white male Zebu, which was then dedicated to Brahman with appropriate ceremonies in the temple; thereafter, he was the property of Brahman and was sacred. This is the origin of the term Brahman cattle.

The breed has been found to be particularly well adapted to American range conditions.

In 1848 the Sultan of Turkey gave Mr. Davis, U. S. Minister to that country, a few line Indian bulls and heifers, which Mr. Davis brought to his plantation in South Carolina. Here they did exceptionally well and rapidly spread through that part of the South. This herd, however, was practically extinguished during the Civil War. Later, an emissary of the British Government who was studying the culture of cotton on the plantation of a Mr. Barrow in Louisiana was anxious to reciprocate for the hospitality and courtesies of Mr. Borrow, and sent him several fine specimens of Brahman cattle. Later still, a gentleman of Mississippi acquired two famous Brahman bulls, one named Richard 3rd, and the other Khedive.

From these cattle and others have been bred the purebred herds in this country as well as many thousands of crossbred Brahman cattle extending from the Rio Grande on the west to Florida and the Atlantic Ocean on the east.

The cattle come in many colors, though steel or silver gray is usually preferred. Brahmans are particularly noted for their immunity to ticks and excessive heat. They are good rangers and the cows make excellent mothers, their milk being very rich. In support of this, an official test showed the milk of a purebred Brahman cow to contain 7.5 percent butter fat.

Attempts to combine the tolerance of Brahman cattle to tropical and semi-tropical conditions with the superior beef-producing qualities of the country's major beef breeds are being made by the U. S. Department of Agriculture. Pasture produces beef economically. Along the Gulf Coast from Florida to Texas are pastures which may be grazed nearly the year-round. But the American breeds that thrive in cooler climates do not do so well under the semi-tropical conditions along the gulf. In experiments conducted at the Iberia Livestock Experiment Station, Jeanerette, La., under the immediate supervision of A. O. Rhoad, Aberdeen-Angus cattle were crossed with the Brahmans.

There are wide differences between them. The popular breeds originated in England and Scot-

land and were accustomed to moderate climates, whereas the Brahmans originated in tropical India. They are characterized by short hair, a rather large hump over the shoulders and excessive skin in the region of the navel and dewlap. In attempting to develop new types by crossing the two species, Department scientists were interested in determining the relative resistance of the British beef breeds, Brahmans and their crosses to climatic factors, such as high temperature and high humidity, and to the effect of sun and shade on respiratory rate, body temperatures and grazing habits.

At the beginning of a warm day following a warm night, breathing rate of the purebred Guzerats was normal—about 15 per minute. The halfbreds' and quarterbreds' respirations were about 30 a minute, and the purebred Angus, 70 respirations. When the animals were placed in the sun, respirations increased rapidly for the threequarters and purebred Angus. The respiration of the halfbred and purebred Guzerats increased only moderately. When the threequarters and purebred Angus were placed in the sun, body temperatures shot upward and continued to rise for a short time even after the animals were led back to shade. The halfbred and purebred Guzerats with shorter hair and more sweat glands, were able to throw off excess body heat and retain a nearly normal body temperature. The Aberdeen-Angus and other beef breeds sweat very little while a Guzerat may sweat profusely.

Throughout the observations it was noted by Mr. Rhoad that hot weather did not influence rumination of purebred and halfbred Guzerats. But the threequarter and purebred Angus often ceased ruminating when temperatures became excessively high during the day. The ability of the purebred and crossbred Guzerats to withstand heat shows in a practical way. In observations of time spent in grazing during a bright, hot day, the purebred Guzerat spent three-fourths of the daylight hours grazing. The Angus spent only half a day. When resting, the purebred Angus went to a shady spot, while the Guzerats remained in the sun. The halfbreds and quarterbreds spent almost as much time grazing as the Guzerats, but rested part of the time in the shade and part in the sun.

The Department's investigations showed that the Angus-Guzerat calves reached a weaning weight about three weeks ahead of Angus calves, indicating greater adaptability. Some crosses are better than others. For instance, threequarter Angus calves from purebred Angus bulls and half-

bred Angus-Guzerat cows were growthier than calves from a crossbred sire and a purebred Angus dam. This is probably explained by the fact that Angus-Guzerat cows give more milk than purebred Angus cows, and as a result the calves from the crossbred cows grow faster. The studies thus far, Mr. Rhoad points out, have proved the desirability of Brahman blood in cattle in the Gulf Coast area. These experiments over a considerable time should reveal the proper percentage of Brahman blood for the most satisfactory crossbred type.

In crossing purebred Brahman bulls on our native cattle or on British breeds, these fine qualities of the Brahman cattle retained in the cross to such an extent that even halfblood and above Brahman animals will be immune to ticks. The crosses are larger in size, make excellent gains either on the range or in the feed lot and better still, will usually dress out a much higher percentage of meat. These cattle are making a distinctly constructive contribution to the livestock economy of the United States, and any cattleman, farmer or feeder in the Coastal area would do well to look into the merits of this fine breed.

This description of Brahman cattle would not be complete without a word or two about the American Brahman Breeders Association. The owners of the herds in 1924, believing that the Brahman cattle possessed the merit of permanence in our livestock world, formed the American Brahman Breeders Association, which is duly incorporated under the laws of the State of Texas for the registration of worthy individual animals of the Brahman breed, and with the sanction of the Department of Agriculture of the Federal Government.

The Association has registered some 25,000 head of cattle and has members in the United States, Mexico and the West Indies. In the last few years, and in particular since the formation of the registry association, the breeders of Brahman cattle have enjoyed a nice export business, cattle moving to Mexico, Cuba, Porto Rico, Central American Republics, the Isle of Trinidad, Australia and the Fiji Islands.

Fertilizer Practices in the South

Condensed from Armour

Dr. H. B. Mann

Southern Manager, American Potash Institute, Inc., Atlanta, Georgia

DURING the past ten years important changes have taken place in fertilizer practices in the South. The general acceptance of the program of limitation of acreages devoted to the major cash crops has involved expansion in the areas planted to soil-improvement crops. Experiment stations and farmers have found that the old ratios in fertilizer formulas are not suitable in the new and more widely followed systems of rotations.

Cotton remains the principal cash crop, followed in importance by tobacco. The use of soil-building crops with them in systematic rotations is now being more extensively practiced than ever before. With the growing use of legumes, however, have come serious problems in plant nutrition, and the amounts and proportions of nutrients are being modified to meet the changing conditions.

In many instances where legumes, such as vetch, lespedeza, winter peas, and crimson clover, are being returned to the soil by turning under, it has been observed that certain plant-food deficiency symptoms are appearing in the succeeding crop of cotton. Since these crops add only nitrogen, the usual amounts of potash and phosphate are often not sufficient to make a proper balance, and yields are below expectations. The result has been that the cotton plants mature too soon, shed their leaves prematurely, the bolls stop growing before reaching full size, only partially open, and the cotton is of poor quality. This condition is known throughout the South as "cotton rust" or potash deficiency.

Even more serious is the growing practice of completely removing legumes from the soil for use as feed crops. This is resulting in heavy losses of plant food, and deficiencies are following where steps are not taken to guard against them. For example, peanuts are regarded as a soil-building crop if grazed off, but if the entire plant is havested, more plant food is taken off than would be returned in three years of normal fertilizer applications to cotton. Peanuts remove a large part of the available potash, and

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where only average amounts are applied when cotton follows in the rotation, yields are invariably reduced.

Experiment stations have found that the solution to the rust problem which is not only occurring in connection with the use of legumes, but where potash has been exhausted through continuous cropping, is the use of fertilizer mixtures high in potash, such as 6-8-8. Where there are extreme deficiencies side-dressings of potash alone or in combination with nitrogen are advocated.

To obtain the highest yields and the best quality of tobacco, experiment stations are placing a great deal of emphasis upon the proper amount of potash in the fertilizers for this crop. As a result the percentage of this element has been growing constantly in recent years and now most analyses used contain from 8 to 12 per cent potash.

But despite the improvement in fertilizer practices and cropping systems, low income per farm is still regarded by agricultural leaders as the most serious problem facing the South. To bring about an improvement in this situation, they are advocating livestock production to supplement returns from the established cash crops, and there has been a rapid expansion in both beef cattle and hog raising in recent years. It is recognized, however, that until the yields per acre of feed crops are increased it will be impossible to build up livestock production substantially.

The yields of corn, the principal feed crop and one that is inadequately fertilized, for instance, average from 12 to 15 bushels per acre in the Southern States compared with 30 to 35 bushels per acre in the States of the Midwest. At present there is not enough corn produced in some Southern States to feed the livestock already on farms, not to speak of the requirements of animals for market.

In order to develop a successful livestock program in the South, farm leaders realize, therefore, that the most important steps to be taken are to increase the yields of feed crops and improve grazing conditions of pasture lands. The only way these objectives can be reached is through proper cropping systems and fertilization. Alabama Experiment Station records show that yields of corn may be increased as much as 20 bushels per acre at a cost of 19 cents per bushel through the judicious use of fertilizer and when the corn was used in connection with a livestock program the conclusion was reached that "a well-managed hog program or combined hog and hen program will pay off all costs the first year if the

farmer makes sure to provide adequate fertilizer with which to provide adequate corn to feed the hogs or hogs and hens." Likewise a recent survey of Southern agronomists indicated that the South, with proper fertilization, can produce sufficient corn for home consumption, and, with the exception of Florida, there is a possibility for commercial production.

New attention is now being given oats in connection with the program of expansion in the livestock industry. In some of the Southern States the acreage in this crop has been low, and because little or no fertilizer has been used, the yields have been much under those in other sections. With the renewed interest there appears to be an effort to raise the yield levels through the more generous use of fertilizer.

Pasture improvement is now receiving widespread attention in the South. Experiment stations have shown conclusively that beef and milk production can be profitably increased and the grazing period extended by the use of fertilizers, and thousands of farmers are putting their recommendations into practice. They are finding that productive pastures are the cheapest source of feed and that milk and beef cannot be produced successfully and economically without them.

Recently reported experiments in northern Louisiana showed that pastures receiving 400 pounds per acre of a complete fertilizer produced about twice as much grass and 30 per cent more milk per acre than did unfertilized pastures.

At the experiment station at Calhoun, Louisiana, over a 4-year period pasture receiving a complete fertilizer gave an increase of 134 per cent more milk, 35 days more grazing, and $15.44 larger returns per acre than did unfertilized pasture.

At Lufkin, Texas, 40 acres of improved fertilized pasture have a carrying capacity of 30 head of cattle, while unimproved pasture provides for only one head to 20 acres. An experiment in Kentucky has shown that the production of beef is three times as great by the use of fertilizers and the cost reduced a third. At the Black Belt Station of Alabama, fertilizers produced more than 300 pounds of beef per acre at a profit of $3.50 per acre on the fertilizer applied.

Co-operating with farmers, the fertilizer industry, experiment stations, and State agricultural boards of control are striving continuously to improve the grade and quality of fertilizers. As a result practically all of the Southern States have eliminated the lower grades and in their places have come higher analyses at lower costs per unit of plant food.

Are They Vermin? (IX)

E. Lawrence Palmer

Prof. of Rural Education, Cornell University

TURKEY VULTURE

Cathartes aura septentrionalis
(Wied)

Description—Length, to 32 inches; wing spread, to 6 feet; weight, to 5 pounds. Black, except adults head is red. Wings, broad and long. Tail, medium-rounded and usually closed in flight. Sexes about equal in size and appearance. In flight, head is inconspicuous.

Where found—Soars in great circles slowly or perches humpbacked on elevation or near dead animal matter; flocks.

Range—Breeds southern Canada to northern Mexico and Gulf Coast to Minnesota and southern New York. Winters in range but south of Ohio Valley, Nebraska, and California.

Relations and life history—One American species. Closely related to condor and black vulture. Nest, a hollow log, stump, or cave near water. Eggs, 1 to 3, white usually spotted with brown or lavender, 2.9 by 1.9 inches. Incubation by female only and for 30 days. Young naked, blind, and helpless when hatched but soon covered with white down. Probably a single yearly molt in the adults.

Behavior—Feeds largely on dead animals which it detects from high in the air and to which it attracts other vultures. May eat dead fish and garbage. Locates its food by sight; some persons believe it has a strong sense of smell, but this seems doubtful. Hisses defiance when disturbed.

Reaction to heat, light, and moisture—May begin nesting in March in southern part of range. Molts from April to October.

Relation to man's interests—Essentially a useful scavenger. Has been accused of but not proved to be an important agent in distribution of hog cholera. Hardly considered vermin. Protected in New York and in 31 other States.

For the Farmer's Library

These books are recommended as outstanding in their field:

Pork Production

By William W. Smith, Professor of Animal Husbandry, Purdue University. Published by the Macmillan Co. $3.75.

(See Farmers Digest, September, 1939)

Feeds and Feeding

By F. B. Morrison, Professor of Animal Husbandry and Animal Nutrition, and head of the Animal Husbandry Department, Cornell University. Published by the Morrison Press. $5.00.

(See Farmers Digest, October, 1939)

Farm Meats

By M. D. Helser, B.S.A., M.S., Professor of Animal Husbandry, Iowa State College; Chief in Meat Investigation, Iowa Agricultural Experiment Station. Published by the Macmillan Co. $2.90.

(See Farmers Digest, January, 1940)

Beef Cattle

By Roscoe R. Snapp, Associate Professor of Animal Husbandry, University of Illinois. Third edition is to be published this fall. Published by John Wiley & Son, Inc. $4.00.

(See Farmers Digest, November, 1939)

Dairy Cattle and Milk Production

By Clarence H. Eckles, B.S.A., D.Sc., late Chief, Division of Dairy Husbandry, University of Minnesota, and formerly Professor of Dairy Husbandry, University of Missouri. Published by the Macmillan Company. $3.60.

(See Farmers Digest, February, 1940)

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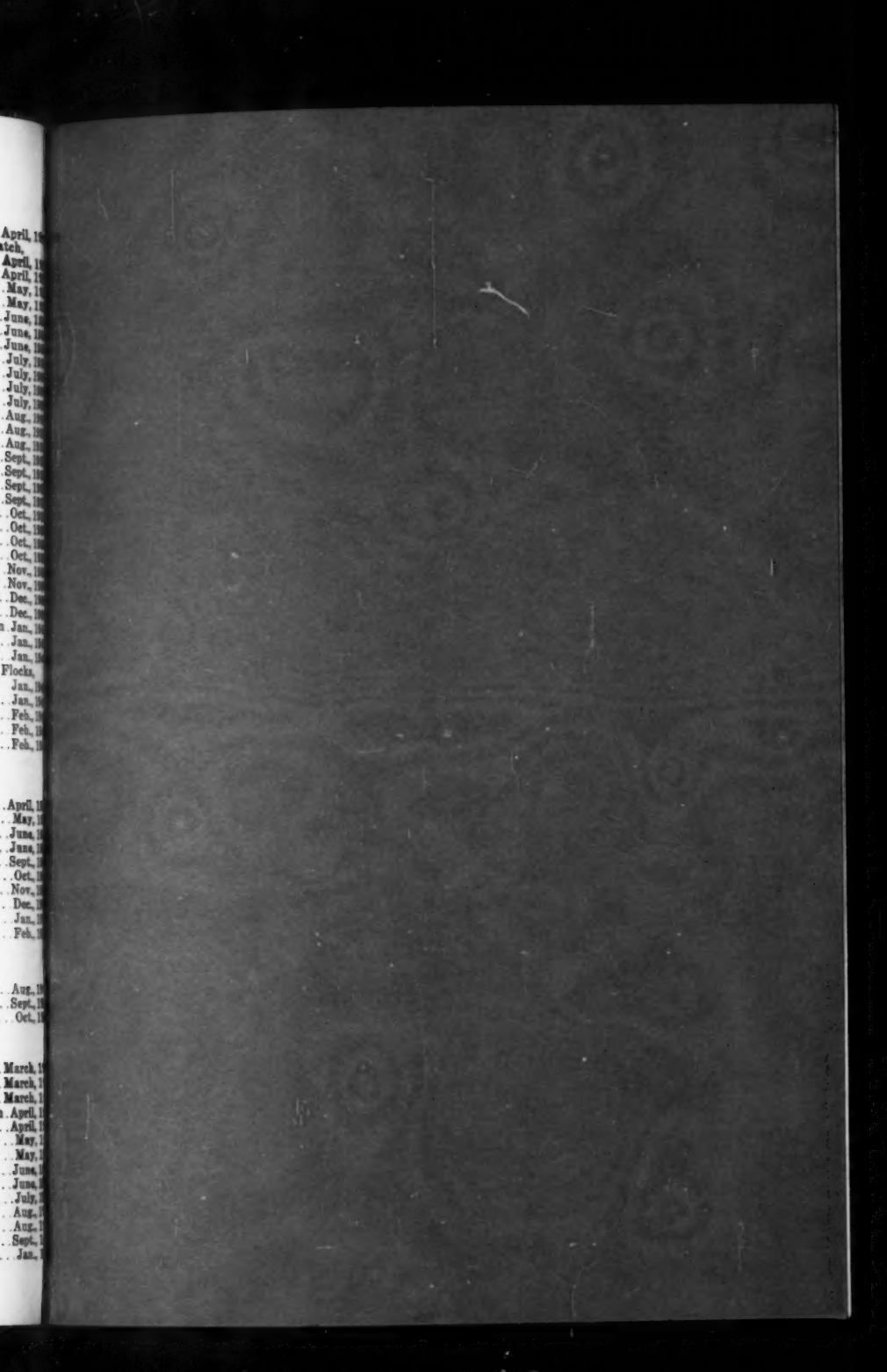

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